The Streblid Batflies of Panama
(Diptera Calypterae: Streblidae)

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AND
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The Streblidae, like the Nycteribiidae, are blood-sucking pupiparous flies and are obligate parasites of bats. All are external parasites except the females of the Old World genus *Ascodipteron,* which embed themselves in the skin of the host and become endoparasitic. Like their hosts, the Streblidae are primarily tropical in distribution. Relatively few species occur in the subtropical and warm temperate zones. Their distribution and host-parasite relationships suggest an ancient origin and dispersal. The Old and New World faunae have no streblid taxa in common, even on bats of the families Molossidae, Emballonuridae, and Vespertilionidae which are represented in both hemispheres. Of the streblid subfamilies, the Nycteriboscinae (= Brachytarsininae, with three genera, and about 45 species) and the Ascodipterinae (one genus and 17 species), are restricted to the Old World; the Nycterophiliinae (one genus, four species), Trichobiinae (18 genera, about 69 species), and the Streblinae (four genera, 21 species) occur only in the New World. The greatest diversification of genera and species has occurred on families of bats that are endemic to the New World, especially the Phyllostomidae.

The radiation of the New World Streblidae is correlated not only with taxonomic and biological diversity of the hosts, but also with adaptations of the flies to living and feeding on particular body regions of their hosts. Some bats like *Phyllostomus hastatus* normally harbor three or four species of Streblidae at the same time, and most hosts harbor at least two. The co-

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existence of these parasites seems to be possible because of their feeding specializations.

The adaptive radiation of the Streblidae is reflected in a wide range of size, form, and structure. The minute mite- or louse-like species of *Mastoptera* may be as small as 0.74 mm. long, while gravid females of *Joblingia schmidti* Dybas and Wenzel may attain a body length of 5.55 mm. The latter is the largest species of streblid known. Reduced wings have evolved independently a number of times in such apparently unrelated genera as *Megistopoda, Aspidoptera, Mastoptera, Joblingia,* and *Metelasmus.* Wings are absent in *Paradyschiria.* The legs of the louse-like species are usually short and powerful for clinging to the host. In *Megistopoda* and related genera, the venter forms a shield whose anterior margin is upwardly reflexed like the tip of a ski. In these flies, the hind legs are greatly elongated and apparently assist the fly in moving through the fur of the host by pushing. The Streblinae, which can appress themselves against the wing membranes of the host are compressed dorso-ventrally and have very short fore- and midlegs. The species of *Nycterophilia,* which resemble fleas in form and movement, are very strongly, laterally compressed. A postgenal ctenidium has apparently evolved independently in the Streblinae and in *Eldunnia.*

Many of the relationships between genera are obscured by convergences in adaptive modifications like those mentioned. Comprehensive morphological and biological studies are needed to clarify both the intra- and interfamilial relationships. We agree with Hennig (1941) that the Streblidae and Nycteribiidae are closely related families of calypterate Diptera, and that neither are closely related to the Hippoboscidae. Cooper's (1941, p. 126) notes on the chromosomes and karyotypes of these families supports this view. Little more can be said at this time about their relationships with other Diptera.

The principal earlier papers dealing with the New World Streblidae are those of Speiser (1900), da Costa Lima (1921), and Kessel (1925). These are now of historical and nomenclatural interest only. From 1936 to 1949, Jobling (see references) published a series of eight important papers dealing with the taxonomy of New World species. He also published several papers (1929, 1949b, and 1951) that dealt rather extensively with the morphology of both Old and New World species. In these superbly illustrated studies, he described only three new species and one new genus, but he redescribed 21 species, re-defined eight genera and revised three. During the same period, important contributions were also made by Guimarães, Pessôa and Guimarães, and Hoffmann (see references).

We consider about 42 species of the previously described New World Streblidae to be valid. Seventeen of these have been reported from Panama by Kessel (1924, 1925), Curran (1934, 1935), Jobling (1936, 1938, 1939, 1949a), Bequaert (1940), and Cooper (1941). Except for the material reported upon by Cooper, most of the specimens treated by them were obtained by Major Lawrence H. Dunn, Medical Corps, United States Army (see Introduction by Fairchild). In the present paper, we treat 84 species, 50 of them new. Sixty-six (44 new) are recorded from Panama. In the collections of Chicago Natural History Museum, there are more than 30 additional undescribed neotropical species. An explanation of the reasons for this relatively great increase in number of species is warranted.

First, the collections upon which earlier authors based their studies were small and included mostly common species from abundant and widely distributed hosts. The present study is based on about 12,000 specimens collected from more than 50 of the 100 species of host bats collected in Panama. We have also studied about 10,000 additional neotropical Streblidae in the collections of Chicago Natural History Museum. Obviously, one may expect to discover a number of completely new species in collections of this magnitude. This is an important factor in explaining the number of new species recognized by us, but it is only one.

Second, the approach to streblid systematics was very conservative in the past. The paucity of specimens and the inadequacy of the data largely prevented one from using host data in parasite discrimination. There was also a reluctance to exploit certain taxonomic characters such as those of the male genital apparatus. The resulting taxonomic "picture" was that of relatively few species, quite variable morphologically and occurring on a variety of host species.

Third, in past collecting, little care was taken to safeguard against contamination or errors of association. It was not uncommon to place several host species in the same field bag, or to collect specimens from a skinning table and to arbitrarily assign the number or name of the host which the collector thought most probable. Many of the specimens reported in the literature were removed from preserved specimens in museum collections, or from the bottoms of jars which, at one time or another, contained several species of host bats.

Finally, the hosts were frequently misidentified. While this was often due to hasty and uneducated guesses in the field, it was also due to the primitive state of bat taxonomy in the nineteenth and early twentieth centuries. Even today, a sophisticated specialist may be unable to adequately characterize and/or identify many neotropical bat species and so-called races.

In this study, we were most fortunate in not being handicapped, as were earlier authors, by the inadequacy of collections and host data. The collections made in the Panama survey, consisting of several thousand lots, were taken from individual bats representing more than 50 host species. Errors of association, though they occurred, were kept to a minimum (see "Techniques and Methods," below.).

The host bats were carefully and uniformly identified by one person, Dr. C. O. Handley, Jr., as he pursued his revisional studies on the mammals of Panama. Any changes in host identification have been made in the streblid data, too, insofar as possible. The accurate host identifications and associations were essential for parasite discrimination (for a discussion of parasite discrimination, see Mayr, Linsley and Usinger, 1953, p. 113).

Consequently, we were able to examine and carefully compare large series of parasites from the same host as well as from different host species. This enabled us to re-evaluate taxonomic characters used in the past and to exploit new ones such as the male gonapophyses. It was soon evident that series of closely related species had been confused under such names as *Trichobius dugesii* and *Euctenodes mirabilis,* and further, that many of them exhibit a remarkably high degree of host specificity.

In our citations, we have omitted many of the earlier references. As noted above, the host records published in many earlier papers are unreliable. Further, transfers of Streblidae to other hosts in the same roosts are fairly common, though apparently mostly transitory. In addition, a species may be replaced by another species on the same host in another geographic area (and possibly habitat). This is common but not well understood. For these reasons and because of the extensive taxonomic and nomenclatural changes made in our study, it is not possible to verify or correct most of the published records without examining the specimens upon which they were based.

Acknowledgments

About 10,000 of the Panamanian Streblidae studied were collected by personnel of the Environmental Health Branch, Office of the Chief Surgeon, United States Army, Caribbean, including Charles M. Keenan, Lt. Col. (then Major) Vernon J. Tipton, and Lt. Col. (then Major) Robert M. Altman. They were assisted in the field by Vicente Alvarez, Wilbur Lowe, Edmund Mattaden, Pantaleon Sanchez, and Sulpice Modestin, and in the laboratory by Wilbur Lowe. Many other specimens were collected by: Dr. Pedro Galindo and Eustorgio Méndez of the Gorgas Memorial Laboratory; Dr. Charles O. Handley, Jr. and Francis M. Greenwell of the Smithsonian Institution, Washington, D. C.; Dr. Nathan Gale, Canal Zone Veterinarian; and Dr. Conrad E. Yunker of the Middle America Research Unit. A few specimens collected earlier by Col. F. S. Blanton, while he was stationed in the Zone, were also examined. To all these persons, as well as to numerous unnamed individuals who assisted in the field, we express our appreciation.

The status of much of this material could not have been worked out had it not been for extensive ancillary material collected on various expeditions by former and present staff members, associates, and field collectors of Chicago Natural History Museum. Among these are: H. A. Beatty (Surinam); Philip Hershkovitz (Surinam and Colombia); Celestino Kalinowski (Peru); Rodger D. Mitchell and Luis de la Torre (Guatemala); the late Colin C. Sanborn (Trinidad and Peru); the late Franklin J. Schmidt (Guatemala); and the late Karl P. Schmidt (Guatemala and Peru). The enthusiastic cooperation of these people helped us acquire basic collections that made study of the Panamanian material possible. A small collection made in Guatemala by F. J. and K. P. Schmidt in 1936 first interested the senior author in studying the Streblidae. Later, in 1948, R. D. Mitchell and L. de la Torre accompanied the senior author to Guatemala. Here they collected the largest assemblage of New World Streblidae that had been obtained up to that time.

In addition, a number of other specimens were borrowed from other institutions. For their cooperation in making this material available, we wish to thank: Dr. Thomas H. G. Aitken of the Trinidad Virus Laboratory

(Rockefeller Foundation) at Port-of-Spain; Prof. Dr. Max Beier, Naturhistorische Museum, Vienna, Austria; Drs. Joseph Bequaert and Philip J. Darlington of the Museum of Comparative Zoology, at Harvard University; Dr. Elli Franz and Dr. Heinz Felten, Senckenberg Naturforschende Institut, Frankfurt a/Main, Germany; Dr. Paul Hurd, California Insect Survey, University of California at Berkeley; Dr. J. Knox Jones, Museum of Natural History, University of Kansas; Dr. C. Machado-Allison and Dr. J. Racenis of the Department of Microbiology, Universidad Central de Venezuela, Caracas; Dr. C. J. Marinkelle, Universidad de los Andes, Bogota, Colombia; Dr. Harold Oldroyd, British Museum (Natural History), London; Dr. L. L. Pechuman, Cornell University, Ithaca, N. Y.; Dr. Alan Stone, United States National Museum, Washington, D. C.; Prof. Dr. Herbert Weidner, Zoologisches Staatsinstitut und Zoologisches Museum, Hamburg, Germany; Drs. Paul Arnaud and P. Wygodzinsky, American Museum of Natural History, New York.

We were also assisted by a number of persons who supplied us with information regarding collections in their care. For this we wish to thank Dr. Walter Forster, Zoologische Sammlung des Bayerischen Staates, Munich, Germany; Dr. H. D. Folkhard, Naturhistorische Museum, Bern, Switzerland; and Dr. H. Schumann, Institut für Spezielle Zoologie und Zoologisches Museum, Humboldt Universität, Berlin.

A special expression of gratitude is owed: Dr. B. Jobling, now retired, of the Wellcome Institute of Tropical Medicine (London) for supplying us with information regarding material on which he had published and for giving us permission to use a number of his illustrations, of which he furnished us copies; Dr. T. C. Maa for supplying unpublished information resulting from his study of streblid types and for his opinions on certain taxonomic and nomenclatural problems; Prof. Oskar Theodor, Hebrew University Medical School, Jerusalem, for advice and assistance; Dr. Lindolpho Guimarães for lending us his published illustrations of *Paradyschiria "dubia";* Miss Marion Pahl, Staff Artist, Chicago Natural History Museum, for preparing some of the illustrations; and Lt. Col. Hugh Keegan, MSC, Chief of the Department of Entomology, 406th Medical General Laboratory, Tokyo, Japan, for supervising the preparation of a number of beautifully executed drawings by members of his staff.

We are also indebted to Dr. Luis de la Torre, College of Pharmacy of the University of Illinois, Dr. Karl Koopman, American Museum of Natural History, and Mr. Philip Hershkovitz, Chicago Natural History Museum, for supplying information regarding relationships of host bats and certain host data; and Mr. Henry S. Dybas, who collaborated with the senior author in his early work on the Streblidae and who from time to time has given encouragement.

Above all, we are indebted to Dr. C. O. Handley, Jr. not only for the invaluable material collected by him, but especially for his untiring cooperation in supplying and re-checking host identifications and other data, and for providing valuable information on the habits of host bats. Without his cooperation, this paper could not have been written.

Unless otherwise specified, all Panamanian specimens were collected by

Charles M. Keenan and Lt. Col. V. J. Tipton, assisted by personnel of the Environmental Health Branch. Where initials of an institution are given in brackets, it indicates that the specimens concerned are from the collections of that institution. Where the initials GML appear following data, but not in brackets, the specimens concerned were collected by personnel of the Gorgas Memorial Laboratory. The initials MA preceding a host number indicate field numbers of Dr. Carlos Machado-Allison of the Universidad Central de Venezuela.

Abbreviations used for collections are as follows:

AMNH	American Museum of Natural History, New York.
BISHOP	Bernice P. Bishop Museum, Honolulu, Hawaii.
BMNH	British Museum (Natural History), London.
BVP	B. V. Peterson, Entomology Research Institute, Canada Department of Agriculture, Ottawa, Ontario.
CAS	California Academy of Sciences, San Francisco.
CIS	California Insect Survey, Department of Entomology and Parasitology, University of California, Berkeley.
CNHM	Chicago Natural History Museum, Chicago, Illinois.
CU	Department of Entomology, Cornell University, Ithaca, New York.
DZSP	Departamento de Zoologia, Secretaria da Agricultura, São Paulo, Brazil.
EHB	Environmental Health Branch, Office of the Chief Surgeon, United States Army Forces Southern Command, Fort Amador, Canal Zone.
FCUCV	Departamento de Microbiología, Faculdad de Ciencias, Universidad Central de Venezuela, Caracas.
GML	Gorgas Memorial Laboratory, Panamá, Panamá.
INM	Instituto Nacional de Microbiología, Buenos Aires.
KU	Snow Entomological Museum, University of Kansas, Lawrence.
LACM	Los Angeles County Museum, Los Angeles, California
MCZ	Museum of Comparative Zoology at Harvard University, Cambridge, Massachusetts.
MNHN	Museum Nationale d'Histoire Naturelle, Paris.
OT	Oskar Theodor, Department of Parasitology, Hebrew University, Jerusalem.
SNI	Senckenberg Naturforschende Institut, Frankfurt a/Main.
TVL	Trinidad Regional Virus Laboratory (Rockefeller Foundation), Port-of-Spain.
USNM	United States National Museum, Washington, D. C.
ZMHU	Institut für Spezielle Zoologie und Zoologische Museum, Humboldt Universität, Berlin.
ZMH	Zoologisches Staatsinstitut und Zoologische Museum, Hamburg.

Techniques and Methods

Collecting Hosts.—As one can determine from Dr. Handley's account (see "Checklist of Mammals"), bats roost in a remarkably wide variety of situations. Accordingly, collecting techniques were varied and often novel. Bats that could not be obtained in any other way were brought down with dust shot. This was often necessary where they were roosting high in a hollow tree or cave. When possible, shooting should be avoided, because of undue disturbance of the parasites.

A variety of nets and net-collecting techniques were employed. Where bats roosted in culverts, it was common procedure to place a loose mesh net (fish seine) over one end and to send a man through the culvert from the other end. He literally pushed the bats ahead of him with a leafy branch. As the bats "hit" the net at the other end, they were quickly removed by men wearing gloves. One person stood alert with a hand insect net, to capture bats that escaped through side openings. If the culvert was impassible, firecrackers were thrown in the open end. Bats in tree holes were obtained by essentially the same technique, the net being strung over the opening, and a leafy branch or bough of appropriate size introduced through one side and pushed up into the cavity to dislodge the bats.

Hand insect nets (with coarse mesh bags) are often useful in caves, especially near the openings. They may also be used to collect bats, such as *Saccopteryx*, that roost on tree trunks or under branches.

The roosting places of many bats are inaccessible or unknown. The use of "mist" nets makes it possible to obtain many of these species and their parasites. Immediate removal of the bat and its parasites lessens the loss or incidence of transfer. Dr. Handley found it desirable to remove some of the very active streblids from the bats while they were still enmeshed in the net.

Collecting Parasites.—Most of the host bats collected in the Panama survey were, upon capture, immediately placed in individual paper or plastic bags, together with a field number, and etherized. The flies were removed as quickly as possible and placed in vials with the corresponding field numbers. This is important, because they do not preserve as well, if transferred an hour or two after death. Paper bags were discarded after one use. Plastic bags were thoroughly washed and reversed, before being re-used.

In collecting the host, it is essential that it be bagged as quickly and with as little unnecessary handling as possible. Some Streblidae, like *Speiseria ambigua* and *Trichobius uniformis* not only leave the host at the slightest disturbance but will often land on another nearby bat, frequently of another species. Such "disturbance transfers" are not uncommon, among Streblidae of bats caught in nets. These flies often return to the original host, if time and opportunity permits. Others like *Strebla*, though strong fliers, tend to stay with their host, even when disturbed.

While the need for the most rigorous precautions in collecting ectoparasites is well known, in the past they have rarely been observed in the case of batflies. Unfortunately, the same has often been true for many other ectoparasites. Our experience leads us to believe that a substantial number of the host records published for them are valueless.

Preparation and Study.—When possible, identifications should be made using both slide preparations and specimens preserved in 70-75 percent ethyl alcohol. In preparing Streblidae for slide mounts, the following procedures were followed. With *minuten nadeln,* small punctures were made in the abdomen and other membranous parts of the body wall. The flies were then placed in a 10 percent solution of cold or warm KOH for from 5 to 20 hours, washed in distilled water, passed through a series of graded alcohols, including absolute alcohol, cleared in oil of cloves, and mounted in a good grade Canada balsam.

The male terminalia were removed and mounted separately. A slit was made in either the dorsal or ventral wall of the abdomen while the specimen was in oil of cloves. The terminalia were removed through the slit by means

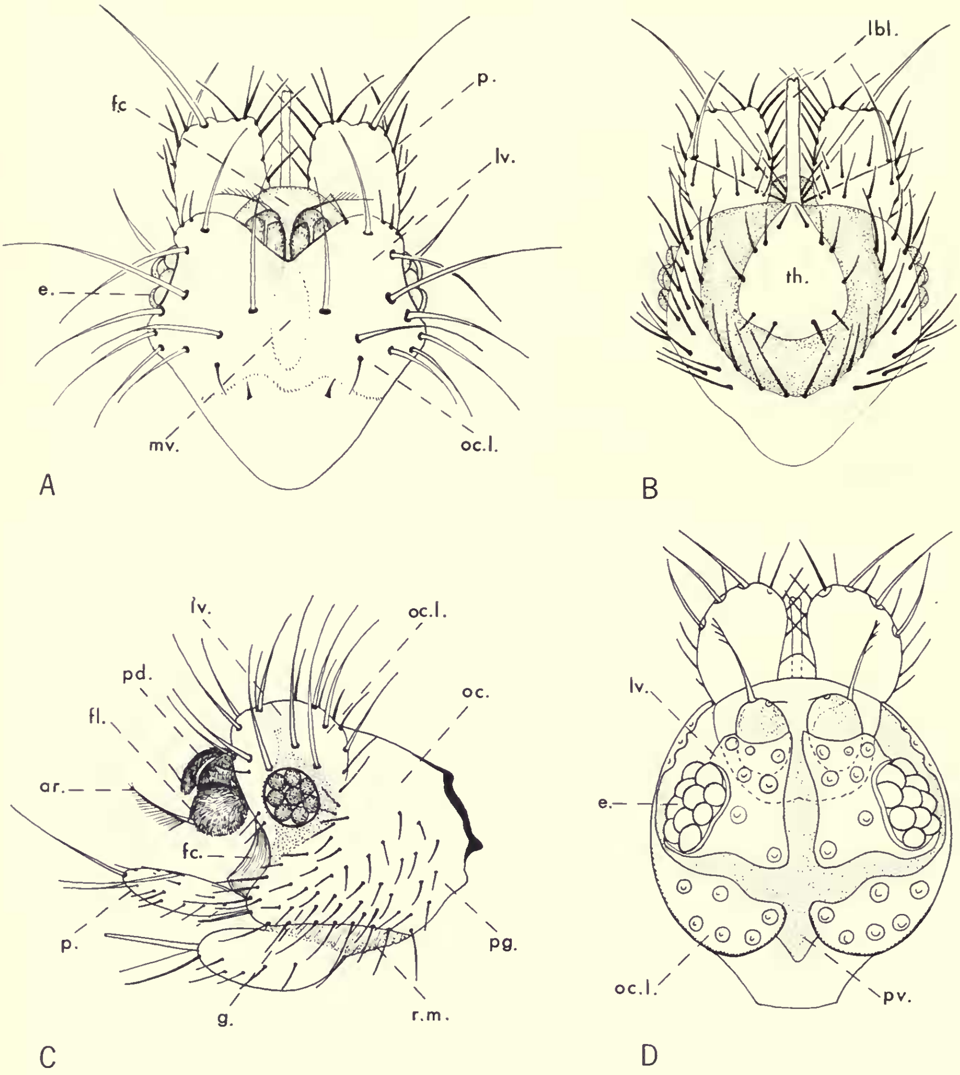

Fig. 38. Structures of streblid head. A–C, *Trichobius sphaeronotus* Jobling. A, dorsal, B, ventral, and C, lateral views of head. D, *Trichobius* sp. (?*longipes* Rudow), dorsal view, semi-diagrammatic, setae omitted. A–C from Zeve and Howell (1962) with modified terminology. D adapted from Jobling (1929). See text for explanation.

of very fine jewelers' forceps. In this way, they could usually be removed *in toto* with much less difficulty than by dissecting them out through the genital "pouch." In order to insure reasonably uniform interpretation of the characters of the gonapophyses, the terminalia were mounted on their right side. Illustrations and descriptions were based on a lateral view. However, in some Streblidae, the gonapophyses are frequently twisted to the left and sometimes only feebly, if at all, curved ventrally. This is true in certain species of *Trichobius*, especially of the *dugesii* and *longipes* groups. When this is so, rotation of the terminalia, as by pressure of the cover slip, may orient the gonapophyses so that they appear to be curved dorso-ventrally when they are actually curved to the left. One must take this into account in mounting and interpreting male terminalia. We believe that we largely avoided such rotation in most of the preparations from which we made illustrations.

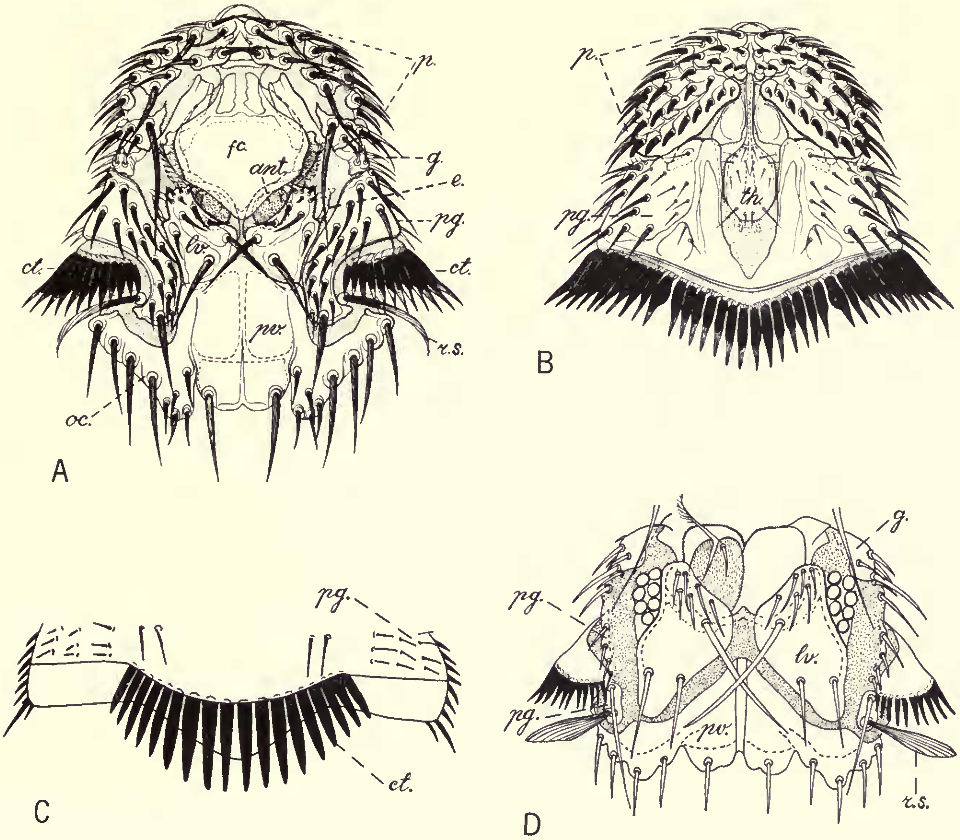

Fig. 39. Structures of streblid head. A, B, *Metelasmus pseudopterus* Coquillet, dorsal and ventral views of head, respectively (post-ctenidial area not shown in B). C, *Eldunnia breviceps* Curran, ventral view of posterior margin. D, *Anastrebla* sp., dorsal view, palpi and frontoclypeal area omitted. A and B from Jobling (1936); C after Jobling 1929. See text for explanation.

It is desirable to remove the wings and mount them separately. This should be done with fine jewelers' forceps or dissecting needles before the fly is placed in KOH. Wings should not be subjected to KOH, but only passed through the graded alcohols and oil of cloves before mounting.

We strongly recommend the use of a high grade Canada balsam in preference to such media as Hoyer's or polyvinyl alcohols. Pieces of glass coverslips, slides, or other supports such as glass or plastic rings of appropriate thickness, must be used to prevent the coverslip from crushing the specimens. We also use small squares, of various thicknesses, of good quality heavy paper such as manila cover paper. They are soaked in xylol before being introduced into the medium. For wing and genital preparation, we have found it very convenient to use 3/8 inch diameter coverslips.

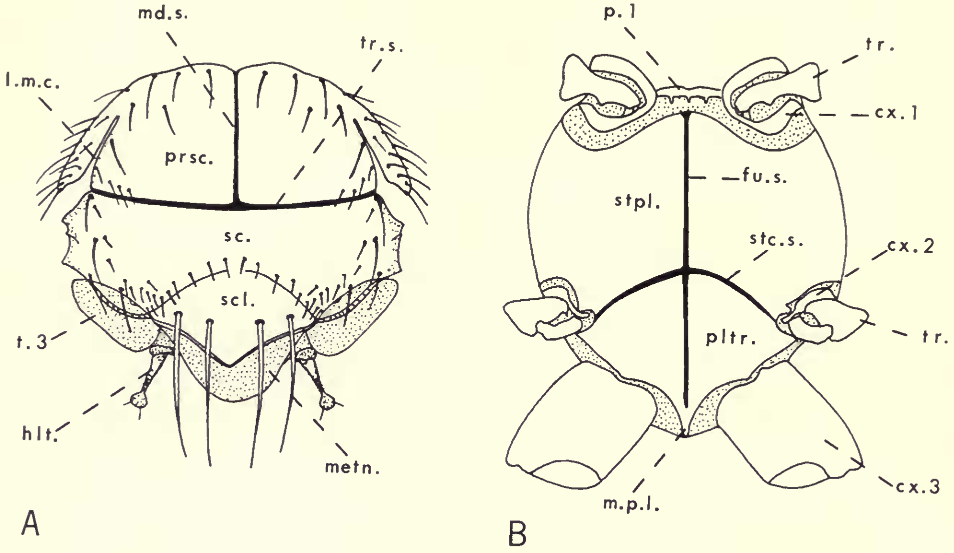

Fig. 40. *Trichobius sphaeronotus* Jobling. A, dorsal and B, ventral views (semi-diagrammatic). Adapted from Zeve and Howell (1962). See text for explanation.

Measurements.—All measurements given are in millimeters. Wing length (WL) has been measured from the fractureline (fig. 42, *f.l.*) at the base of the radius to the apex of the wing; width (WW) was measured at the broadest portion. The base of the radius was selected as a measuring point, because it was rarely damaged or removed in dissecting off the wings for slide preparations, while axillary sclerites were frequently damaged or lost. Body length (BL) has been measured from anterior margin of frontoclypeus to apex of abdomen, thoracic length (TL) from anterior margin of prescutum to posterior tip of metanotum. FL = length of femur.

Illustrations.—The photographic illustrations were prepared as follows: paper negatives were made by projecting slide preparations onto enlarging paper; positive prints were made on contact print paper, as with film negatives, emulsion to emulsion, the light exposure being made through the paper negative. Although this technique has many limitations, it saves much time in preparing illustrations of material for which it is suited. Other illustrations made by us were prepared from slide preparations with the aid of a microprojector.

Figures 76–78 (A, B), 97–99, and 122–124 were executed by artists of the 406th Medical General Laboratory in Tokyo. Illustrations borrowed from Mr. Jobling are credited to him in the legends. Most of the remaining drawings were prepared by the senior and junior authors, in collaboration.

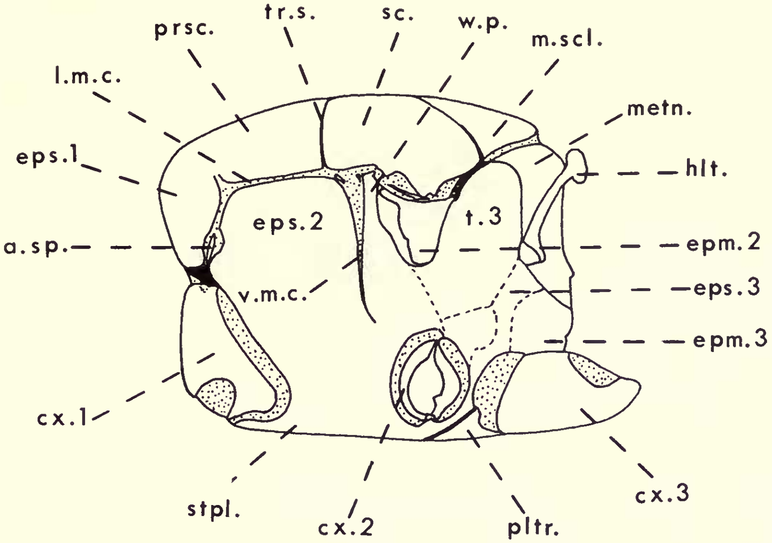

Fig. 41. Thorax, lateral view (diagrammatic), *Trichobius* sp. Adapted from Zeve and Howell (1963). See text for explanation.

MORPHOLOGY AND SYSTEMATICS

Morphology

The comparative morphology of the Streblidae has been treated in several papers by Jobling (1929, 1936, 1938, 1958). Zeve and Howell (1962, 1963) treated the morphology of three North American species of *Trichobius* of the *major* group. These authors differ with Jobling in the interpretation of certain structures. It is obvious that further detailed studies covering a broad taxonomic representation of the family must be undertaken if one is to resolve these differences and to arrive at a better understanding of other structures not investigated in detail by either. We were not in a position to undertake such studies. However, we feel it is desirable to discuss some of these differences in interpretation and to explain the terminology used by us. Unless otherwise noted, the following discussion concerns only New World Streblidae.

Head.—The head of New World Streblidae has been described by Jobling (1929, 1936) and by Zeve and Howell (1962). The terminology employed for head structures in this paper is shown in figs. 38, 39. In the *caecus*, *pallidus*, and *major* groups of *Trichobius*, the subdivisions of the vertex are not clearly differentiated (fig. 38A, C) into subregions. In these, there is a median, membranous or less distinctly sclerotized mediovertex (*mv.*) ; the anterior subregions or laterovertices (*lv.*) and the posterior subregions (occipital lobes, *oc.l.*) are usually separately rounded or separated by a vague transverse groove; laterally they may be partially separated by a membranous strip (fig. 38C). In most other Trichobiinae and in the Nycterophiliinae, the laterovertices and occipital lobes are well differentiated (fig. 38D) ; especially in those species in which the head is flattened dorsally.[4] In these, the occipital lobes may be more or less flattened plates. Zeve and Howell (loc. cit.) appear to interpret each side of the entire dorsum posterior to the antennae as the laterovertices. Until a detailed comparative study can be made of the head, we prefer to use the terms indicated above. The posteromedian area, called the postvertex (*pv.*) may be membranous (fig. 38D) or form a sclerite (fig. 39A, D). In the Streblinae, the postgenae extend posteriorly on the dorsal surface, as conspicuous plates (fig. 39A, *pg.*) in *Strebla* and *Metelasmus*, or as a sclerotized strip in *Anastrebla* (fig. 39D). In the Streblinae the occipital plates have a festooned posterior margin, as does the postvertex, and, a conspicuous postgenal ctenidium is present on the underside (fig. 39B). This extends around to the dorsal surface (fig. 39A, D). A short ventral ctenidium is also present in *Eldunnia* (fig. 39C).

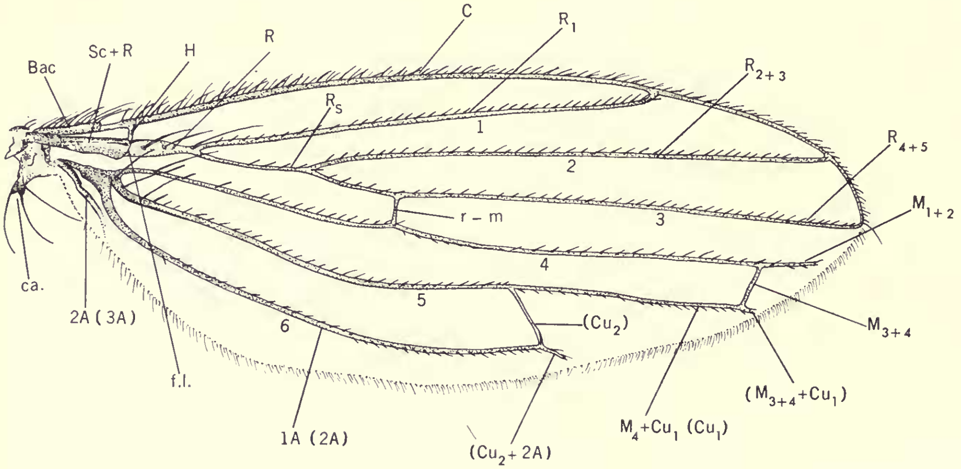

Fig. 42. Wing, *Trichobius sparsus* Kessel. Adapted from Jobling (1938). See text for explanation.

Thorax.—The principal structures referred to in our descriptions are illustrated and labeled in figs. 40, 41. A few remarks are in order. The mesonotum (fig. 40A) consists of mesoprescutum (*prsc.*), mesoscutum (*sc.*) and mesoscutellum (*scl.*). In our descriptions, we have not qualified these with the prefix but have referred to them simply as prescutum, scutum, and scutellum.

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[4] Pessôa and Guimarães (1940, figs. 2, 3) figured the head of *Nycterophilia.* Their illustrations do not show the laterovertices as distinct from the narrow occipital strips, as they appear in stained material. On the basis of their interpretation, they assigned the genus to the Nycteroboscinae (Brachytarsininae).

Zeve and Howell (1963) have referred to the upper portion of the mesepisternum and mesepimeron as the mesoanepisternum and mesoanepimeron, respectively. Since there is no suture separating the mesoanepisternum from the mesokatepisternum, etc., we prefer to simply use the term mesepisternum (fig. 41, *eps.* 2) and mesepimeron (*epm.* 2) for taxonomic purposes. Jobling (various papers) has referred to the mesepisternum as the mesopleuron. Since this includes the mesepimeron as well, we use the more restrictive term.

Zeve and Howell (loc. cit.) have referred to the two major divisions of the venter of the thorax (fig. 40B) as meso- and metasternum. We have employed the terms sternopleura (*stpl.*) and pleurotrochantines (*pltr.*) primarily because of past usage by Jobling. We are not able to judge which terms more truly reflect the composition of these sclerites. The median posterior margin of the pleurotrochantines may be produced as a lobe, called by us the median pleurotrochantinal lobe (*m.p.l.*). In some species, for example in the *longipes* group of *Trichobius,* this may ascend dorsally and unite with the metepimeron (fig. 62A).

Wings.—Jobling (1936 and 1938) treats the wing venation of the Streblidae. Zeve and Howell (1963) agree with him in their interpretation of the anterior veins of the wing, but differ as to the posterior ones. In fig. 42, we have shown the terminology of Jobling (1938). Where it differs, we have shown the terminology of Zeve and Howell in parentheses. In our descriptions, we have tried to avoid confusion by using names or symbols for the costa, R_1, and R_S and referring to the other veins by number. In those species of *Nycterophilia* that have fully developed wings (fig. 52), only a few anterior veins are well developed and sclerotized; remnants of some vannal (?) veins are also sclerotized. Nine others seem to be represented by rows of setae. If these rows of setae actually represent veins, then a more complete complement is present in the Nycterophiliinae than in any other Streblidae known to date. The anterior venation somewhat resembles that of male *Ascodipteron,* as figured by Jobling (1940), though there are obvious differences. In brachypterous and stenopterous wings (*sensu* Hackman, 1964) venation may be essentially complete and identifiable (*Aspidoptera*) or very much reduced (*Noctiliostrebla, Neotrichobius*). In some undescribed species of *Nycterophilia* the wings are micropterous.

Abdomen.—There are seven pairs of spiracles in all of the known New World Streblidae. Terga I and II are completely fused in the Trichobiinae and Streblinae. They are separated ventrally but fused dorsally in the Nycterophiliinae. Sternum I is much smaller than II in the Trichobiinae and Streblinae, but longer than II in the Nycterophiliinae. In the following discussion, we refer to the abdominal membrane as the connexivum.

Male: The structures of the male abdomen (fig. 44B) are labeled according to the interpretations of Jobling (1951). The fifth sternum (*st.V*) may

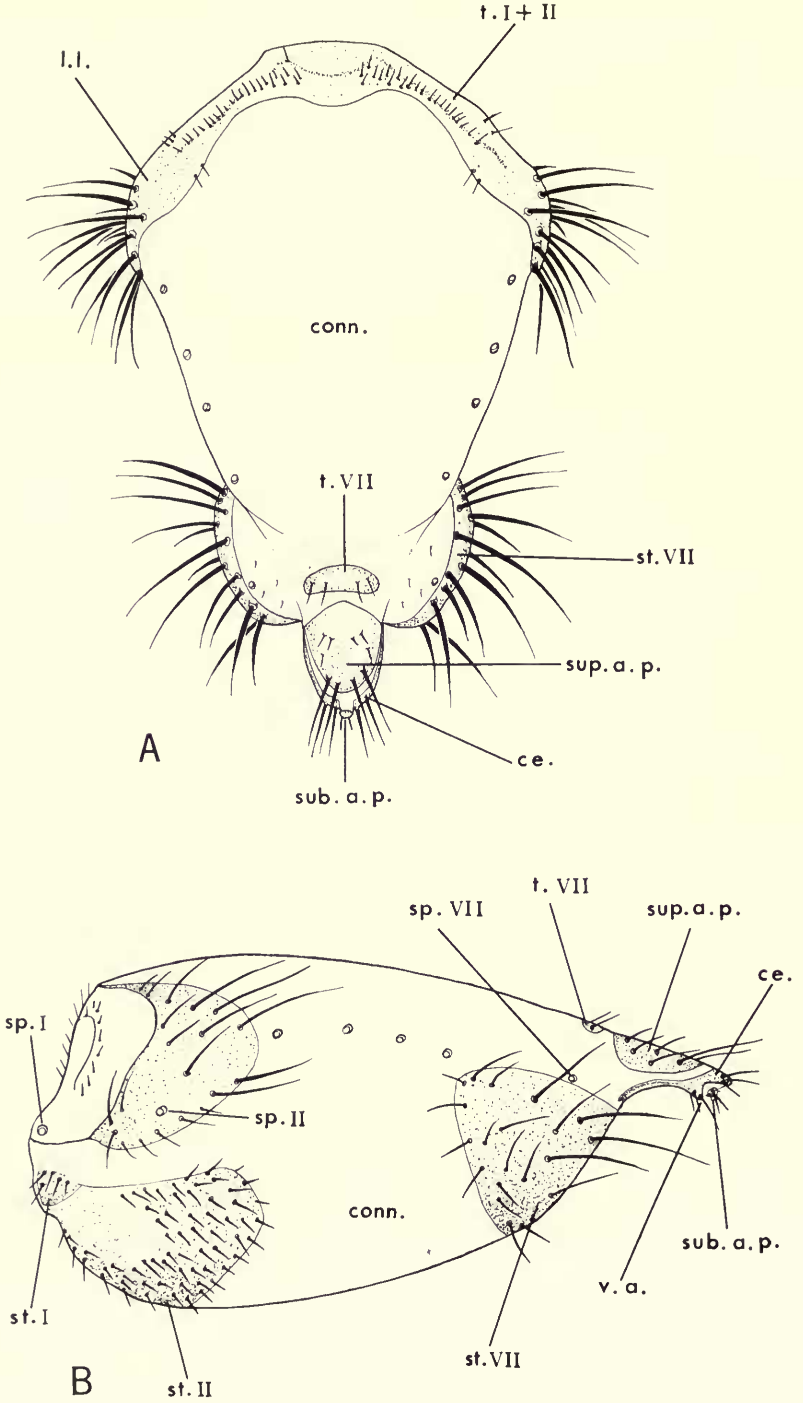

Fig. 43. Female abdominal structures, *Trichobius sphaeronotus* Jobling. A, dorsal, and B, lateral views. Adapted from Zeve and Howell (1963). See text for explanation.

be entirely absent, it may be a single transverse sclerite (in most Streblidae), or it may be divided into two sclerites as in *Anatrichobius* and some species of the *Trichobius major* group. Sternum VI (*st. VI*) may be present, or absent, in related species (*Trichobius*) or well developed in all of the species of a genus (*Strebla*).

Jobling (loc. cit.) and Zeve and Howell (loc. cit.) differ greatly in their interpretation of the composition of the male hypopygium (*hyp.*). Zeve and Howell, contending that the spiracles of segment VII could not be enclosed by a sternum,[5] maintain that the dorsal synsternum VII+VIII of Jobling is a syntergum (VII+VIII). To account for the position of these spiracles, Jobling suggests that part of tergum VII may enter into the formation of the hypopygium. We are in no position to judge the merits or demerits of these opposing points of view. Neither appears to be compatible with the facts.[6] However, we believe Jobling has demonstrated that there has been rotation within the postabdomen, a fact not consistent with the interpretation of Zeve and Howell. For this reason, we have followed Jobling's terminology, though with some reservations.

Synsternum VII+VIII is quite variable in its structure. It may be divided into two clearly separated lateral plates, which lack any dorsal connection (e.g., *Trichobius major*), or it may be continuous dorsally (*Noctiliostrebla* ?) or at least apically (*Strebla*). The suture between VII and VIII may be visible (*Strebla*) or not. Within the same genus (*Trichobius*), VII+VIII may be fused to tergum IX or clearly separated by a membranous suture.

In the genus *Nycterophilia*, the abdomen differs markedly from that of other New World Streblidae. In the male, segments I–VI are represented by clearly defined, sclerotized sterna. The hypopygium consists of a conspicuous synsternum (VII+VIII) whose apex is closed dorsally to form a ring; the apex articulates with a dorso-apical sclerite, tergum IX, which bears the terminalia and the anus. The cerci appear to be represented by very small setose flaps on each side of the anus. Excepting segment IX, the hypopygium is sclerotized ventrally for its entire length.

Male terminalia.—The morphology of the male terminalia (fig. 45B) of the Streblidae has been discussed by Jobling (loc. cit.), Zeve and Howell (loc. cit.) Theodor (1954), and Theodor and Moscona (1954). The internal clasper-like structures were referred to as claspers by Jobling (1936) and later (1951) as gonapophyses. Zeve and Howell (1963) also use the term gonapophyses. Theodor (1954) has referred to them as parameres. In fig. 45B we have not shown the U-shaped sclerites illustrated by Jobling and Zeve and Howell.

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[5] The position of the spiracles does not in itself seem to us to be a valid criterion. In *Nycterophilia*, the first spiracle is so close to the upper margin of sternum I that it sometimes seems to be incorporated in the margin, and the second lies just above the posterior angle of sternum II. In all other New World Streblidae, they are clearly situated on tergum I+II.

[6] Comparison of the structure of the New World Streblinae and Trichobiinae with that of the Old World genus *Brachytarsina* (=*Nycteribosca*) suggests that part of tergum VI may be included in the anterior part of the hypopygium.

In the Trichobiinae and Streblinae, each gonapophysis (*gon.*) typically bears a pair of distinctive ventral or ventro-lateral setae. These paired gonapophyseal setae (*p.g.s.*) consist typically of a macroseta (*ms.*) and a smaller accessory seta (*a.s.*). Other setae may also be present. The accessory seta is posterior to the macroseta in the *uniformis, dugesii,* and *longipes* groups of *Trichobius,* and in *Speiseria, Pseudostrebla, Stizostrebla, Aspidoptera, Mastoptera, Noctiliostrebla, Paradyschiria,* and *Exastinion.* It is anterior to the macroseta in the *major, caecus,* and *phyllostomae* groups of *Trichobius* and in *Joblingia, Megistopoda, Neotrichobius, Paratrichobius, Anastrebla, Metelasmus, Paraeuctenodes,* and *Strebla.* In *Joblingia schmidti,* there are two pairs of macrosetae, and sometimes two pairs of accessory setae. In *Trichobioides perspicillatus,* the accessory seta is ventral or ventral and slightly posterior to the macroseta. In *Eldunnia* there are four well-developed setae in a row, the two posterior setae shorter than the two anterior ones.

Generally, the paired setae are similar in position on the two gonapophyses and are inserted along the ventral margin near base. However, they may be situated near mid-length or (as in *Paratrichobius* and related genera) near apex. In *Trichobius phyllostomae* and related species, their location may differ markedly between the two gonapophyses. In some (e.g., *Trichobioides*), the paired setae may be inserted on the lateral face of the gonapophysis.

We have not studied the aedeagus (*aed.*) in detail, though its structure differs between genera and species. In many New World Streblidae, the extrusible portion of the aedeagus is dorso-ventrally flattened and ribbon-like, but it may be cylindrical or even flagelliform. In others (e.g., *Noctiliostrebla*), it is blade-like in profile and may even have a dorso-apical spine. In most (except *Nycterophilia, Noctiliostrebla,* and *Paradyschiria*), its posterior portion is coiled, and extrusion is accomplished through straightening of the coil by contraction of muscles associated with the aedeagal apodeme (*aed.a.*). In *Nycterophilia,* the apodeme is short and straight. In *Noctiliostrebla* and *Paradyschiria,* it is feebly coiled.

In the Trichobiinae and Streblinae, there is a pair of flap-like, usually setose structures in the wall of the genital pockets and closely associated with the dorsal connection of the membrane to the gonapophyseal sheath. These are referred to by Jobling (1951) as the surstyli.

In *Nycterophilia,* unlike any other Streblidae except *Ascodipteron,* the terminalia are external, and consist of three principal elements (fig. 45A). There is an outer pair of "claspers," each consisting of a long cylindrical clasper shaft (*cl. sh.*) which is continuous with the body wall of tergum IX and not separated from it by a suture of any kind. Each of these bears a distal, movable harpago (*ha.*). Internal to the claspers and articulated to the ventral apical margin of synsternum VII+VIII is another pair of broad clasper-like structures, apparently homologous with the gonapophyses of other New World Streblidae and, like them, each bearing a pair of ventral setae. Situated between the gonapophyses is the extrusible, ribbon-like

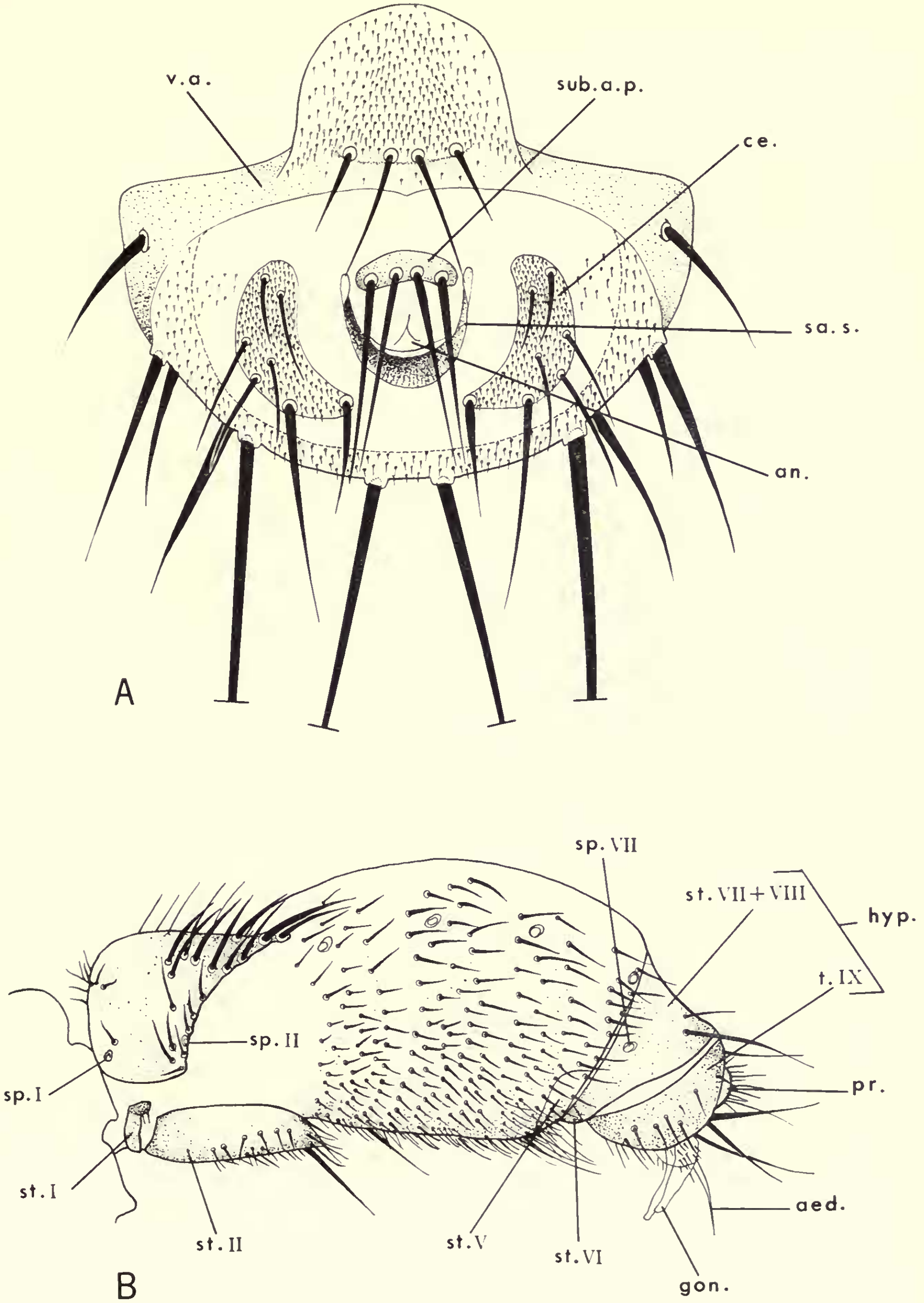

Fig. 44. A, female terminalia, ventral view, *Strebla christinae*, new species. B, male abdomen, lateral view, *Strebla* sp. B adapted from Jobling (1951). See text for explanation.

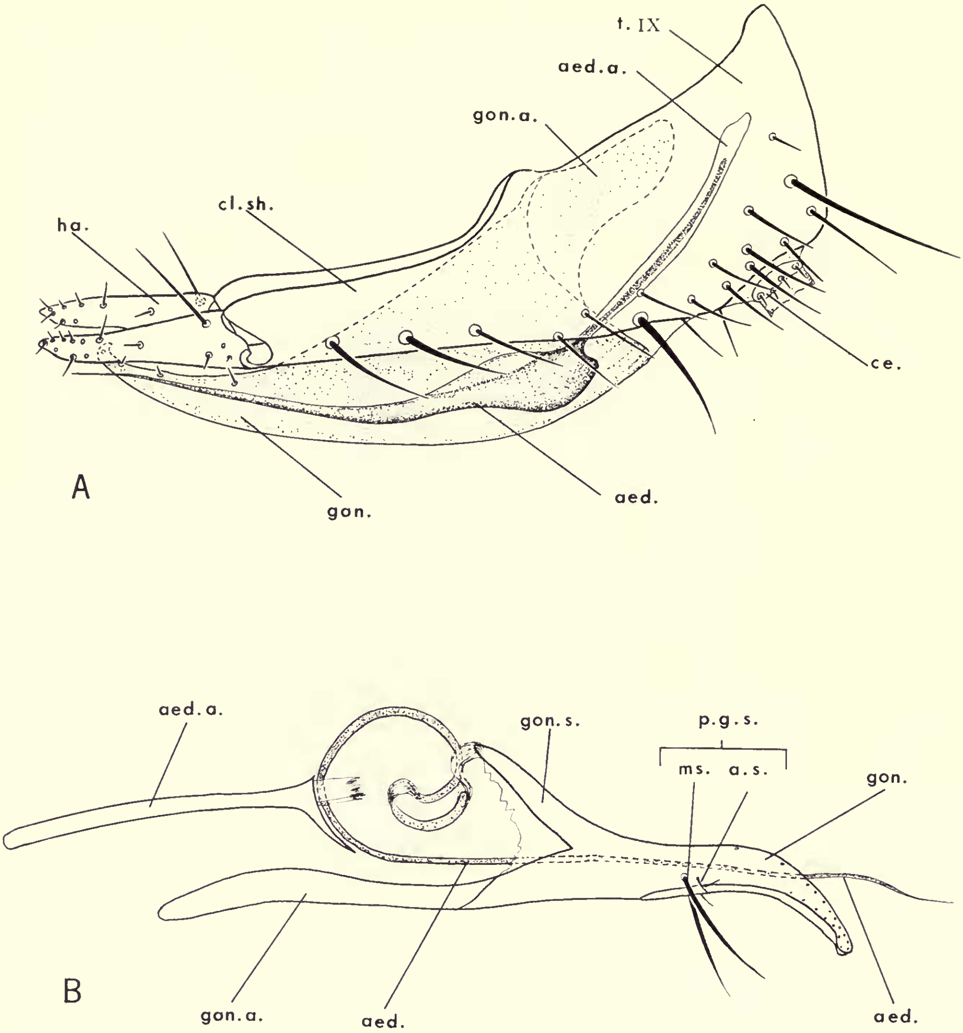

Fig. 45. Male terminalia. A, *Nycterophilia parnelli,* new species. B, *Strebla* sp. (U-shaped sclerites omitted). See text for explanation.

aedeagus. This has a simple, short apodeme which cannot be coiled as it can in most other New World Streblidae.

We believe the abdominal morphology shows that the species of *Nycterophilia*—in spite of the remarkably specialized flea-like adaptions—are the most generalized New World Streblidae known. Interestingly, the only other Streblidae which, like *Nycterophilia,* seem to approach a generalized type, are the males of *Ascodipteron.* In these, the abdominal terga and sterna, though weakly sclerotized, are identifiable. The females of *Ascodipteron,* on the other hand, are the most highly specialized, morphologically and biologically, of all the Streblidae.

Abdomen.—Female: Jobling (1951) and Zeve and Howell (1963) agree in their interpretation of segments I–VII in the female abdomen. Although they differ in the terminology they apply to the apical structures, neither seems to have resolved the homologies. Our preliminary studies indicate that characters of the postabdomen are not only of value in identifying species, but may assist in an understanding of relationships within the family.

Tergum VII varies greatly in extent, shape, and sclerotization. It is best developed in *Strebla.* Sometimes it is not at all pigmented but may be represented by micropile and/or paired setae. Occasionally, it is united or even completely fused with the supra-anal plate to form part of the terminal cone (see below). In a very few instances (e.g., *Noctiliostrebla, Joblingia,* and *Trichobius major*) tergum VII may be divided into two tergites.

Zeve and Howell (loc. cit.) have not discussed the segmental nature of the terminal cone (also called hypopygium and proctiger by Jobling). We believe this composite structure to be formed of elements of segments VIII–X (and, theoretically, XI). In some streblids, even tergum VII is fused with the supra-anal plate of the cone. Characteristically, the most conspicuous structure of the cone is a sclerotized ring consisting of a dorsal supra-anal plate (*sup.a.p.*) and a narrow ventral arc (*v.a.*). The supra-anal plate may be longer than wide (fig. 43A) or very short and scarcely longer than the ventral arc (fig. 44A). The ventral arc may be produced anteriorly as a median lobe (fig. 44A) or on each side as a narrow strut (figs. 43A, B). Between the ventral arc and the anus is a small setose sclerite called the subanal plate (figs. 43B, 44A, *sub.a.p.*) by Jobling (1951).

In *Joblingia schmidti,* the cerci are united with the ventral arc, which is separate from the supra-anal plate and so situated as to appear to be a sternum of that plate. This is also true in species of the *Trichobius major* group (fig. 43) and other streblids. The fusion of the cerci to a sternal structure raises a question as to their identity, since cerci are generally regarded as tergal appendages. Perhaps the streblid cerci are paraprocts. In *J. schmidti,* there are also two U-shaped anal sclerites in the wall of the proctiger. One of these (supra-anal sclerite) lies above the anus, the other (infra-anal sclerite) lies below it. These are absent in many species and genera. In *Strebla christinae* n.sp., there is a single supra-anal sclerite (fig. 44A, *sa.s.*).

We restrict the term proctiger (*pr.*) to the membranous projection which bears the anus, anal sclerites, the subanal plate, and the cerci.

In species of the *Trichobius caecus* group, and some other streblids, there is a small sclerotized strip that has an apical crescent-shaped thickening or rim which we refer to as the postgenital sclerite. It is situated between the vulva and the ventral arc. We interpret this as sternum IX. It is best developed in the species of the *Trichobius caecus* group and is useful in identifying them. It is most easily observed in alcohol-preserved specimens and should be examined from a posterior view. Its shape cannot ordinarily be determined from slide preparations.

In the abdomen of female *Nycterophilia,* syntergum I+II and sometimes tergum VII are sclerotized. In non-gravid females, many of the segmental margins are indicated by external indentations of the connexivum. The terminal cone (fig. 51B *t.c.*) is apically produced above the proctiger (*pr.*) and bears conspicuous distal macrosetae. The proctiger is free. The abdominal sterna, though indicated, are incompletely represented and very weakly, if at all, sclerotized. Below the proctiger is a small sclerite that is connected by a sclerotized strip to a small transverse sclerite lying posterior to the vulva. These appear to be comparable to the structures figured by Jobling (1951, fig. 1A, B) for *Nycteribosca gigantea.* He regarded the sclerotized strip as representing sternum X and the sclerite as sternum IX. The latter sclerite is similar in form and position to the postgenital sclerite (see above) of the *Trichobius caecus* group.

Chaetotaxy.—We have used the term microseta for extremely minute setae. In some instances, these may be unusually minute and relatively dense, forming a micropile. They are usually visible only in slide preparations, and some can be distinguished only under oil immersion. The term macroseta has been used for setae that are conspicuously long or longer than other associated setae.

In general, the dorsal abdominal setae are well developed and indeed sometimes very long in brachypterous and wingless species, e.g., the female of *Joblingia schmidti.* In *Nycterophilia,* certain coarse abdominal setae, especially the connexival setae, may appear "braided" even under relatively low magnification. In some instances, their margins appear serrate.

List of Abbreviations

A	anal vein
aed.	aedeagus
aed.a.	aedeagal apodeme
an.	anus
ant.	antenna
ar.	arista
a.s.	accessory gonapophyseal seta
a.sp.	anterior thoracic spiracle
Bac.	basicosta
C	costa
ca.	calyptera
ce.	cercus
cl.sh.	clasper shaft
conn.	abdominal connexivum
c.s.	coxal spur
ct.	ctenidium
Cu	cubitus
cx. 1	procoxa
cx. 2	mesocoxa
cx. 3	metacoxa
d.c.s.	(paired) dorsal abdominal connexival setae
e.	eye
epm. 2	mesepimeron
epm. 3	metepimeron
eps. 1	proepisternum
eps. 2	mesepisternum
eps. 3	metepisternum
e.s.	epi-anal sclerite
fc.	frontoclypeus
f.l.	fracture line of radius
fu.s.	furcasternal suture
g.	gena
gon.	gonapophysis
gon.a.	gonapophyseal apodeme
gon.s.	gonapophyseal sheath
H	humeral vein
ha.	harpago
hlt.	halter
h.s.	hypo-anal sclerite
hyp.	hypopygium
lbl.	labella
l.l.	lateral lobe of tergum I+II
l.m.c.	lateral membranous cleft
lv.	laterovertex
M	medius
md.s.	median mesonotal suture
metn.	metanotum
m.p.l.	median pleurotrochantinal lobe
m.scl.	mesoscutellum (scutellum)
ms.	gonapophyseal macroseta
mv.	mediovertex
oc.	occiput
oc.l.	occipital lobe
p.	palpus (maxillary)
p. 1	pronotum

pd.	pedicel
pg.	postgena
p.g.s.	paired gonapophyseal setae
pltr.	pleurotrochantine (s)
pr.	proctiger
prsc.	mesoprescutum (prescutum)
pv.	postvertex
R	radius
R_s	radial sector
r.m.	rostral membrane
r.s.	remiform scale
sa.s.	supra-anal sclerite
sc.	mesoscutum (scutum)
scl.	scutellum
sp.	spiracle
st.	sternum
stc.s.	sternacostal suture
stpl.	sternopleuron (a)
sub.a.p.	subanal plate
sup.a.p.	supra-anal plate
t.	tergum
t.3	laterotergite (metapleuron of Jobling)
t.c.	terminal cone
th.	theca
tr.	trochanter
tr.s.	transverse mesonotal suture
v.a.	ventral arc
v.g.m.	ventral gonapophyseal macroseta
v.m.c.	vertical membranous cleft
w.p.	wing process

Biological Notes

As indicated above, the Streblidae are obligate pupiparous ectoparasites of bats. There are few published studies or notes on their biology. The only paper of consequence that deals with the habits and life history of New World species is that of Ross (1961) who reported on several species of *Trichobius* that occur in Arizona.

From unpublished field observations of the senior author and of Prof. Kenneth W. Cooper (pers. comm.), it appears that many species occupy rather specific niches on the host, such as the wing membranes, head, or trunk. Many of the modifications of size, form, and structure appear to be adaptations to these niches. Field and laboratory studies are needed to analyze them.

The movements of some of these flies on the wing membranes of the bat are remarkable. Using a low power binocular microscope, we observed that *Paratrichobius dunni* (Curran), *Trichobius longipes* (Rudow), *T. joblingi* n. sp., and various species of *Strebla* run rapidly with equal facility, in forward, backward, lateral, and oblique directions. Their skittery movements reminded one of a bit of mercury rolling on a plane surface that was being tilted in various directions.

The senior author has tried to keep colonies of Streblidae alive in the laboratory. He succeeded only when the flies were kept on the host. Fourteen *Carollia p. azteca* were "deloused" after being caged for several days in the laboratory. Only two were negative for parasites; the remaining 12 had an average of 2.15 specimens of *T. joblingi* and 0.25 specimens of *Strebla carolliae* per bat. When removed, the streblids died in one or two hours or less. This agrees with the experience of Ross (op. cit.), working with Arizona Streblidae. At first, it was thought that the flies died of desiccation. However, they died as quickly when kept in ceramic pots with relatively high humidity. The species handled were *Strebla carolliae* n. sp. and *Trichobius joblingi* n. sp., on *Carollia p. azteca,* and *Strebla mirabilis* (Waterhouse), *S. hertigi* n. sp., and *Trichobius longipes* (Rudow), on *Phyllostomus h. panamensis.* All were collected in the Canal Zone.

These species rarely leave the host. They appear to feed constantly and have been observed "diving" in and out of the fur as they feed briefly and move from one site to another. Why they feed so often is an interesting question. Perhaps it is because rapid conversion and utilization of food are needed to nourish the developing intra-uterine larva. Only one larva matures at a time, and it may be that a short developmental period is required to maintain the population. Unfortunately, nothing is known about the population dynamics of these flies. Nor do we know if the males feed as frequently as the females.

On the other hand, it may be that the continual rapid movements of these flies require a high energy intake. The very active species which were seen to feed constantly stay on the host most of the time. We suspect that the host bats preen themselves and that the movements of the flies are evading actions. More generalized species like *Joblingia schmidti* Dybas and Wenzel and *Trichobius yunkeri* n. sp. do not stay on the host as much of the time nor do they feed as frequently as do the more specialized streblids. Many specimens of *J. schmidti* were found crawling in guano and on the walls of a bat cave. *T. yunkeri* and related species are much less rapid flyers than most *Trichobius* species and may be found in swarms in the roosting places of the hosts.

Whatever the need, the suggestion that food is converted rapidly is supported by the observations of Dr. Phyllis Johnson (pers. comm.). While at the Gorgas Memorial Laboratory, she dissected live specimens of *Trichobius longipes* and *Strebla mirabilis.* She noted that the blood in the gut appeared to have been broken down and absorbed more quickly in these flies than in any other blood-sucking insect she had dissected. This suggests that the short survival time of these flies off the host, might literally be due to exhausting their energy. Dr. Glenn Richards (pers. comm.) has suggested that a need for a high water intake rather than of food might be a more important limiting factor. The problem is an interesting one and warrants study.

At best, the fecundity of these flies must be low. The females do not appear to have a well-developed spermatheca for sperm storage. The species observed by Ross (loc. cit.) mate on numerous occasions. Even if the mortality rate is low and the flies are long-lived, it must require a considerable period of time for a population to achieve sizable numbers. This may explain why the flies are absent or the population density low in certain bat roosts, especially new or temporary sites. For example, an abandoned power house shelter at Madden Airstrip, built during World War II, had a large colony of *Carollia p. azteca* and *Phyllostomus h. panamensis.* No puparia could be found in this shelter nor were any flies seen on the walls or in the air. The bats had few flies. Conversely, population densities of flies like *T. yunkeri* were often very high on bats, like *Pteronotus parnellii fuscus,* which roosted in large colonies in caves or similar long established habitats.

Crude experiments on "homing" and host selection were also undertaken in the laboratory of the Environmental Health Branch at Corozal, to determine the feasibility of future studies along these lines. Specimens of two hosts (*Carollia p. azteca* and *Phyllostomus h. panamensis*) were very lightly anesthetized with ether. Their flies were removed, and the bats were returned to a screened cage. After a few minutes, the flies recovered from the anesthesia. They were released in the room containing the hosts' cage. Most of them flew quickly and directly to the cage and literally clawed and burrowed their way through the screen to return to the hosts. The parasites of these two species of bats always returned to their normal host. Carefully controlled multiple choice experiments along these lines may provide insights into some of the problems of host selection and specificity.

Ross (loc. cit.) observed that the Streblidae which he studied deposited their pupae off the host, sometimes in communal sites in crevices or on the walls and floor of the roosting site. This agrees in general with our observations. We have occasionally found puparia in small numbers in the fur of the bats. We believe this to be abnormal. Ross (loc. cit.) also reported being bitten by Streblidae. We have never observed this, and it may be true only of certain species. Host-parasite specificity is discussed following the section on systematics.

Systematics

There are three described genera of New World Streblidae that have not been taken in Panama. These are *Synthesiostrebla*, *Stizostrebla*, and *Paraeuctenodes*. *Synthesiostrebla* (*amorphochili* Townsend) is known only from Peru. *Tonatia silvicola* (=*amblyotis*) the host of *Stizostrebla longirostris* occurs in Panama, and it is likely that the fly will eventually be collected there, too. We have seen specimens of *Paraeuctenodes* from Trinidad and from Guatemala. Thus, it seems likely that the genus is represented in Panama.

The following key is designed not to reflect relationships of genera, since these are largely obscure, but to facilitate identification.

KEY TO THE GENERA OF NEW WORLD STREBLIDAE

1. Body strongly, laterally compressed, flea-like (fig. 46). Wings, if fully developed, with most veins represented only by rows of setae (fig. 52); wings sometimes reduced to inconspicuous strut-like structures. *Male* (figs. 49, 50): Pre-abdomen with sterna I–VI sclerotized and distinct; terminalia (fig. 45A) external, aedeagus lying between well-developed gonapophyses, these in turn lying between conspicuous claspers (Nycterophiliinae) .... *Nycterophilia* Ferris

   Body, if laterally compressed, never flea-like. Wings, if fully developed, with six longitudinal veins (fig. 42); wings sometimes reduced to oval or elongate structures, or (rarely) completely absent. *Male:* Pre-abdomen (segments I–VI) with only sterna I and II sclerotized and distinct; I usually very small, sometimes reduced to a very small sclerite on each side; terminalia internal, consisting of aedeagus and a pair of gonapophyses (fig. 45B) 2

2. Head with a ctenidium (fig. 39) 3

   Head without a ctenidium (fig. 38) 7

3. Ctenidium consisting of only 18–19 spines, restricted to postero-ventral part of head (fig. 39C); palpi "free," with normal setae, not forming a triangular shield for the front of the head .... *Eldunnia* Curran

   Ctenidium consisting of numerous spines, extending around sides to dorso-lateral parts of head (fig. 39A, B, D); palpi very broad, festooned with numerous, heavy thorn-like setae, together forming a triangular shield for the front of the head (fig. 39A, B; Streblinae) 4

4. Wings brachypterous. Dorsal connexivum of abdomen covered with setae (fig. 140). Prescutum with a complete median suture. Postgena, behind the ctenidium, with a remiform scale (fig. 39A, *r.s.*) .... *Metelasmus* Coquillet

Wings macropterous. Dorsal connexivum of abdomen bare (but with micropile), except for segmentally arranged pairs of setae. Median suture of prescutum usually short, never complete 5

5. Hind tibiae long and slender, with numerous short setae, lacking conspicuous macrosetae on upper edge 6

Hind tibiae with at least two, sometimes six or eight macrosetae on upper edge; in some species as many as 12-13 setae conspicuously longer than the others .... *Strebla* Wiedemann

6. Postgenae, behind the ctenidium, each with a laterally directed remiform scale (fig. 39D, *r.s.*) .... *Anastrebla* n.g.

Postgena without a remiform scale. .... *Paraeuctenodes* Pessôa & Guimarães

7. Wings normally developed and functional 17

Wings much reduced or absent 8

8. Wings absent, or represented only by a very minute, inconspicuous flap 9

Wings reduced, but conspicuous 10

9. Minute species, body 1.29–1.48 mm. long. Legs of approximately equal size. Scutum membranous except for a short sclerotized strip connecting the prescutum and scutellum on each side (fig. 114A) .... *Paradyschiria* Speiser

Larger species, body 1.70–2.48 mm. long. Hind legs greatly elongated, at least twice as long as the front legs (fig. 101A). Scutum sclerotized, the suture between it and the scutellum rigid .... *Megistopoda* Macquart

10. Venter of thorax shield-like (fig. 98), anterior and posterior margins broadly rounded, the anterior margin dorsally reflexed and runner-like. Hind legs elongated, conspicuously longer than the others 16

Venter of thorax not thus. Hind legs, if elongated, not conspicuously longer than the others 11

11. Median mesonotal suture extending posteriorly beyond the transverse suture to the scutellum (figs. 79, 83) 15

Median mesonotal suture not extending posteriorly beyond the transverse suture... 12

12. Median and transverse mesonotal sutures united to form an inverted "Y" (fig. 108A); longitudinal and vertical membranous clefts closed without evidence of a suture. Laterovertices of head each with a longitudinal pigmented suture.... .... *Noctiliostrebla* n.g.

Median and transverse mesonotal sutures, united to form an inverted "T" (fig. 103A); longitudinal and vertical membranous clefts present (open) or, if closed, the line of fusion is marked by a heavily pigmented, rigid suture 13

13. Posterior margin of head rounded. Median mesonotal suture not bifurcate anteriorly; both longitudinal and vertical membranous clefts open 14

Head with two oblique flap-like occipital lobes, whose truncated posterior margins are festooned with setae (fig. 105E). Median mesonotal suture bifurcate anteriorly; longitudinal and vertical membranous clefts closed, the line of fusion marked by heavy pigmented sutures .... *Exastinion* n.g.

14. Palpi slightly longer than wide, nearly vertical. Dorsum of abdomen clothed with short setae. *Male:* Sternum V absent; gonapophyses with accessory setae inserted posterior to the macrosetae. .... *Aspidoptera* Coquillet

Palpi oval, nearly horizontal. Dorsum of abdomen clothed with long setae (figs. 76A, 78A). *Male:* Sternum V present, divided into two rounded sternites; gonapophyses with accessory setae inserted anterior to the macrosetae (fig. 78C) .... *Anatrichobius* n.g.

15. Minute species, 0.73–1.29 mm. long, with short legs. Wings with indistinct venation; with an (rarely, two) apical, setigerous, digitiform process (fig. 83) .... *Mastoptera* n.g.

Large species, 3.96–5.55 mm. long, with powerful, elongated legs. Wings with distinct venation, without an apical digitiform process (fig. 79) .... *Joblingia* Dybas & Wenzel

16. Inner face of profemora with stout spines (fig. 97). Mesepisternum divided into dorsal and ventral parts by a horizontal, longitudinal, membranous cleft similar to that separating the prescutum from the mesepisternum. Wings with only three longitudinal veins (fig. 99C) .... *Neotrichobius* n.g.
Inner face of profemora lacking stout spines; mesepisternum not divided into two parts by a membranous cleft. Wings with four or more longitudinal veins (figs. 100D, 101E) .... *Megistopoda* Macquart

17. Middle of anterior prescutal margin (fig. 115A) with two closely placed, sharp teeth which fit into grooves on the posterior part of the head; humeral calluses strong, flat projections which fit under posteroventral margin of head. Costal vein heavily sclerotized, wider and bearing strong setae from base to junction with R_1, beyond which it is narrower, less strongly sclerotized, and bears short setae; *r-m* near fork of R_s (fig. 115A) .... *Synthesiostrebla* Townsend
Anterior margin of prescutum often sinuate, with blunt median projections, but never with a median pair of sharp teeth. Costa usually rather uniform in width and sclerotization throughout its length, *r-m* situated some distance from fork of R_s (fig. 86A) 18

18. Upper surface of posterior tibiae with at least two, sometimes five or six, macrosetae which are conspicuously longer than the others 22
Upper surface of posterior tibiae with setae more or less uniform, never with conspicuously longer macrosetae 19

19. Venter of thorax shield-like, as in *Megistopoda* and *Neotrichobius* (fig. 98), broadly rounded anteriorly and posteriorly, the anterior margin reflexed upwardly. Inner surface of profemora with a diagonal row of heavy spines (represented by strong setae in one species); hind legs greatly elongated.. *Paratrichobius* Costa Lima
Venter of thorax not thus, the lateral margins oblique anteriorly and posteriorly. Inner face of profemur without spines, though strong setae may be present (fig. 102); hind legs may or may not be greatly elongated.................... 20

20. Palpi with setae along margins only, ventral surface bare, the dorsal surface with micropile but appearing bare under low magnifications. R_1 united with costal vein opposite third crossvein, both with strong macrosetae to this point.. *Trichobioides* n.g.
Palpi with setae on ventral surface and along margins. R_1 united with costal vein at a point distinctly beyond level of third crossvein........................ 21

21. Hind legs greatly elongated and twice as long as the forelegs...... *Speiseria* Kessel
Hindlegs not twice as long as forelegs; if elongated, then fore and middle legs are also elongated.. *Trichobius* Gervais

22. Occipital lobes produced posteriorly as broad flaps (fig. 119A) which overlap the antero-lateral margins of the prescutum, the latter lacking a median suture and produced anteriorly as a truncate median projection which fits between the occipital flaps; genae and postgenae evenly covered with numerous short, posteriorly directed setae of nearly uniform size............ *Stizostrebla* Jobling
Posterior margin of occipital lobes rounded, not flap-like, though a short tubercle may be present; genae and postgenae with both long and short setae; anterior margin of prescutum sinuate, with a bilobed median projection, the median suture well developed, usually complete.. 23

23. Head distinctly broader than long, and as broad as thorax or nearly so; postgenae and occiput (viewed from beneath) conspicuously expanded laterally; postvertex sclerotized, separated from the occipital lobes by a dark suture. *Female:* Ventral abdominal connexivum without a subapical row of blunt spines; cerci not united with the ventral arc........................ *Pseudostrebla* Costa Lima
Head distinctly narrower than thorax; postgenae and occiput not conspicuously expanded; postvertex membranous as in *Trichobius* and *Paratrichobius*. *Female:* Ventral abdominal connexivum with a subapical row of stout spines (fig. 116B); cerci united with the ventral arc.................. *Parastrebla* n.g.

Subfamily **Nycterophiliinae** Wenzel, new subfamily

Until now, only one species of the genus *Nycterophilia* has been described. All specimens recorded by authors have been referred to the type-species, *N. coxata* Ferris, 1916. The senior author has segregated six new species in the collections of Chicago Natural History Museum. Without doubt, additional species exist. Three new species have been identified in the collections from Panama.

The species of this genus differ remarkably from other Streblidae, and one can argue that a new family should be created for them. However, this should not be done until detailed comparative studies are made of the morphology of both Old World and New World Streblidae (including the Ascodipterinae) and of the Nycteribiidae. For this reason, we only propose a new subfamily at this time.

DIAGNOSIS: Body strongly, laterally compressed, flea-like. *Thorax.*—Short and very deep. Mesonotum without a median suture. Spiracles situated just above midpoint between dorsal and ventral thoracic margins. *Wings.*—Either macropterous or micropterous (strut-like); when fully developed, with much reduced venation, only a few anterior veins and remnants of vannal veins sclerotized. *Legs.*—Femora and tibiae with unsclerotized annuli similar to those of Nycteribiidae. Profemora greatly enlarged and strongly, laterally compressed. Tibiae with marginal incrassations (seen in slide preparations). *Abdomen.*—Seven pairs of spiracles present, the first spiracle lying along or above the upper margin of sternum I, the second in the connexival membrane between the posterior angles of tergum I and sternum I. Terga I and II separated ventrally by a membranous suture, fused dorsally. Sternum I longer than II. *Female:* Intermediate sterna not sclerotized or only very feebly sclerotized; tergum VII a very small plate if sclerotized; terminal cone setose, dorsal to proctiger. Seventh sternites present, ventro-lateral in position. Also a small ventral sclerite and strip anterior to vulva. *Male:* Sterna III–VI well developed as distinct sclerites; VII and VIII united to form longitudinal portion of the hypopygium; tergum IX bearing a pair of claspers with a terminal movable harpago, an inner pair of blade-like gonapophyses, and a ribbon-like aedeagus with a short non-coiled apodeme (fig. 45A).

The strongly compressed, flea-like body, the distinctive wing venation, the external male terminalia, the claspers with movable harpago, and the full complement of pre-abdominal sterna in the male, clearly separate this from the other subfamilies of Streblidae. Further, the position of the first and second spiracles differs greatly from that of other New World Streblidae, in which both are situated in tergum I+II.

Jobling (1951) did not discuss the systematic position of *Nycterophilia*, though he apparently regarded it as belonging to the Trichobiinae. Pessôa and Guimarães (1940) assigned the genus to the Nycteriboscinae, but as noted earlier, they appear to have misinterpreted the structure of the head, probably because of a lack of material suitable for study. *Nycterophilia* does possess some features in common with the Nycteriboscinae, especially in the structure of the sterna IX and X in the female. However, similar sclerites are found in some of the Trichobiinae. The genus appears to be more closely related to the New World Streblidae. The presence of paired ventral setae on the male gonapophyses suggests this, as does the number and position of the abdominal spiracles in both sexes, the divided female seventh sternum, and the structure of the male hypopygium. It especially appears to be related to *Trichobius* species of the *caecus* and *pallidus* groups, which, for the most part, occur on the same hosts as *Nycterophilia*. In these, the male cerci are very long and are connected by apodemes to the surstyli, suggesting a resemblance to the clasper shaft and harpago of *Nycterophilia*. On the other hand, the non-pigmented annuli of the legs, the abdominal segmentation of the male, and the external claspers suggest a relationship with the Nycteribiidae.

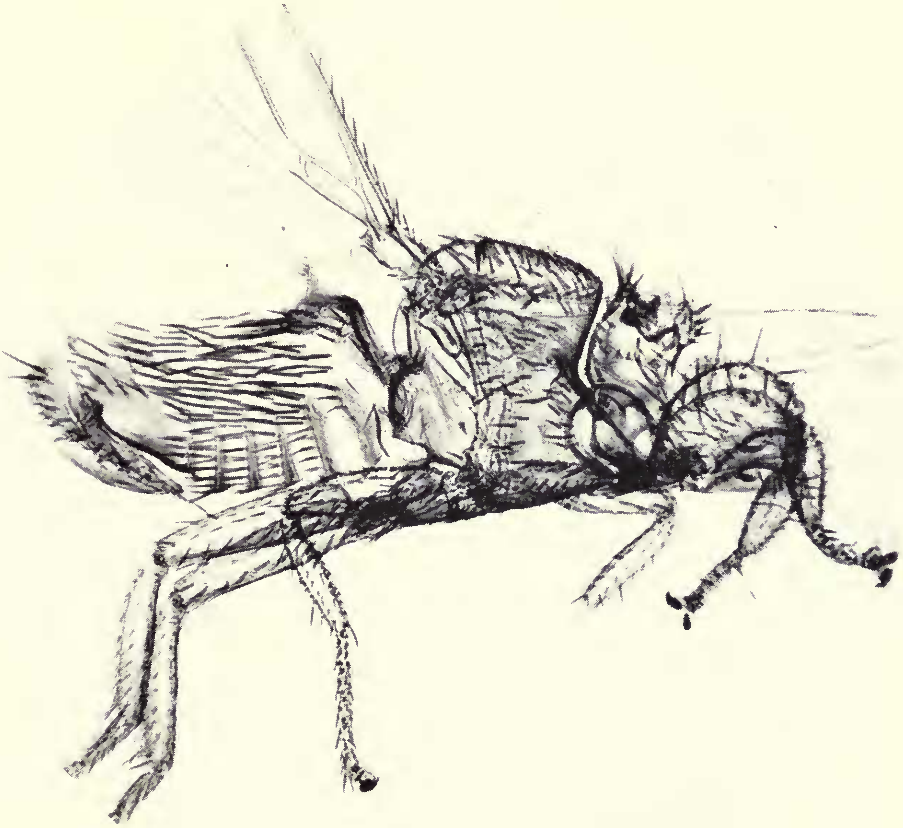

Fig. 46. *Nycterophilia parnelli*, new species, holotype male; lateral view.

We tentatively suggest that both *Nycterophilia* and *Ascodipteron* represent specialized developments from a stock which gave rise to both Streblidae and Nycteribiidae. *Ascodipteron* should probably be regarded as belonging to a separate family, as it was by earlier authors.

Genus **Nycterophilia** Ferris

Nycterophilia Ferris, 1916, Ent. News, **37**: 436–437 (diagnosis). Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., **5**: 25 (keyed), 30 (cit.). Stiles and Nolan, 1931, Bull. Nat., Inst. Hlth., Wash., no. 155, p. 654. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479 (keyed); 1935, Amer. Mus. Novit., no. 765, p. 5 (keyed). Jobling, 1936, Parasitology, **28**: 361, 362 (morph.). Bequaert, 1940, Rev. Acad. Colomb. Cien. Exact., Fis. y Nat., **3**: 417 (keyed); 1942, Bol. Ent. Venez., **1**: 85 (keyed). Jobling, 1949, Parasitology, **39**: 321 (keyed); 1951, Trans. Roy. Ent. Soc. Lond., **102**: 215 (morph.). Maa, 1965, Jour. Med. Ent., **1**: 385 (cit.).

Nycterophila Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 12 (keyed), 13. Pessôa and Guimarães, 1940, Arq. Inst. Biol. São Paulo, **11**: 421–424 (syst. pos.). Schuurmans Stekhoven Jr., 1941, Zool. Anz., **136**: 80.

Type-species: *Nycterophilia coxata* Ferris, 1916.

DIAGNOSIS: Body form strongly, laterally compressed, flea-like. *Head.*—Vertex strongly projecting as dorsal lobes; occiput and post-occiput obliquely declivous, the posterior surface concave and apposed to the anterior margin of thorax. Laterovertices differentiated, bearing the eyes; occipital plates consisting of thin, feebly sclerotized transverse strips. Eyes not always differentiated, never with more than a single facet. Each postgena ventrally produced, below oral cavity, as a process bearing a stout seta; a series of two to five short spinelets present on each side immediately below oral cavity. Theca and palpi vertical in repose.

Thorax.—Short, deep, anterior margin (figs. 46–48) inwardly declivous. Mesonotum without a median suture; transverse suture strong, complete. Scutellum very short and strongly convex, with a pair of closely appressed (partially fused) macrosetae which arise from the same theca. Longitudinal and vertical membranous clefts present, well-defined. Spiracles situated behind anterior margin about halfway between dorsal and ventral margins, or slightly above this. Pleurotrochantinal plate movable, separated from sternopleura by a membranous suture.

Wings.—Emarginate distally in macropterous species; costa, a longitudinal vein, and part of a third vein normally developed and sclerotized anteriorly, and with sclerotized rudiments of two veins in vannal region; also with nine longitudinal rows of setae which may represent reduced veins; longitudinally folded in repose. Wings of micropterous species reduced to short strut-like structures without identifiable venation. Halteres large, conspicuous (fig. 50A, *hlt.*).

Legs.—Femora and tibiae each with a non-pigmented cuticular annulus similar to those of Nycteribiidae. Inner face of profemora with a few discal setae, bearing a pair of heavy spines near base and a blunt spine at about middle above ventral margin, as well as smaller peg-like submarginal spines antero-dorsally; with a ventral groove on inner face for reception of the protibia; outer face with more numerous setae; upper margin with both short setae and macrosetae; with an irregular and incomplete non-sclerotized annulus. Procoxae large, projecting dorsally; latero-ventral and ventral posterior margins armed with heavy or spiniform setae, which form a "pseudo-ctenidium". Middle and hind femora normal, spindle-shaped, clothed with setae and with a few macrosetae, the hind femora longer than the middle ones. Hind tibiae with a pair of conspicuous subapical, bifid, spine-like setae; inner face with dense, short setae on apical half. Protarsi with minute setae ventrally, with spinelets dorsally and laterally. Middle and hind tarsi longer than tibiae; inner face of first segment of hind tarsi with dense, short setae similar to those on inner face of hind tibiae. Tarsal claws with oblique parallel grooves on outer face, sometimes appearing pectinate, though the ventral margin does not seem to be incised.

Abdomen.—Terga I and II separated ventrally by a vertical membranous suture, fused dorsally; a vertical row of marginal setae present on I along suture; lateral lobes of II with discal setae and, on posterior margin, three heavy "braided" spiniform setae, the dorsal one much smaller than the other two. Spiracles situated as follows: first pair just above middle of dorsal margin of sternum I; second pair just above dorsal angle of sternum I on line with interval between I and II; third pair in connexival membrane just below posterior angles of tergum II and above interval between sterna II and III; fourth to sixth pairs situated more dorsally than the preceding, in the connexival membrane just above the lateral connexival setae and opposite intersternal membranes; seventh pair situated more ventrally than the three preceding, being just anterior to the hypopygium and dorsal to postero-dorsal edge of seventh sternites, in the female, and in the middle of the dorsal edge of synsternum VII+VIII, in the male.

Female: Segments III–VI represented, at most, by paired median, dorsal connexival setae; VII represented by setae or by a small setose sclerite. Terminal cone prominent, dorsal to the proctiger, the latter separate and free (fig. 51). Lateral connexivum with micropile and coarse setae which are coarser than those on ventral half. Sterna III–VI at most very feebly sclerotized, if at all, but represented by vertical rows of coarse setae which become coarser dorsally. Ventral to the proctiger is a small sclerotized plate, connected by a sclerotized strip to a small sclerite in front of the vulva. Seventh sternites normally triangular, ventro-lateral in position.

Male: Segments III–VI may also be represented by median paired dorsal connexival setae. Sterna I–VI well developed and sclerotized with coarse spiniform paired median ventral setae and, along sides, with marginal setae along posterior margin, these becoming coarser and "braided", dorsally, similar to the lateral connexival setae; sternum VI fused along median ventral line with anterior portion of hypopygium, the latter long, sclerotized, membranous dorsally except at apex where it is sclerotized and "closed" to form a "ring" together with the ventral portion. The apical portion of the hypopygium a separate sclerotized segment bearing the terminalia. These consist of a long clasper-like, ventral shaft, on each side, which distally bears an articulated "harpago"; a pair of conspicuous gonapophyses between the "claspers" and articulated basally with the ventral posterior margin of the hypopygium; and, between the gonapophyses a ribbon-like (viewed dorsally) aedeagus. The aedeagal apodeme is relatively short and is not coiled. Tergum IX with dorso-apical macrosetae. Cerci a pair of small setose flaps on each side of anus. Spiracles situated very much as in female, but seventh pair situated just within dorsal margin, of hypopygial "ring" at mid-length.

According to Ross (1961, p. 241), the greatly enlarged first pair of legs [profemora] "is not used in locomotion by *N. coxata,* but is held forward at the sides of the head in such manner as to part the fur as it progresses through it." Their well developed musculature suggests that these have other functions, too.

These flies resemble fleas so closely in their movements that they deceive even the expert. When on the host, the wings are folded longitudinally and held over the upper sides of the abdomen. Thus, the similarity to fleas is enhanced. The forms with reduced strut-like wings must be even more flea-like in life.

KEY TO THE SPECIES OF *NYCTEROPHILIA*

1. Dorso-apical spur of hind coxa long, conspicuous (fig. 50A) 3
   Spur short, inconspicuous, sometimes nipple-like (figs. 47A, B) 2
2. Antero-lateral angles of thorax sparsely setose; mesepisternum with a row of submarginal bristles along margins of both the longitudinal and vertical membranous clefts and five or six other, discal setae[7] (fig. 47A). *Female:* Terminal cone with two apical macrosetae (fig. 51C). *Male:* Gonapophyses (lateral view) strongly but evenly tapered from base to apex. Host: *Pteronotus parnellii* ....*parnelli* n.sp.

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[7] The discal setae are those in an imaginary quadrangular area bounded by the longitudinal and vertical membranous clefts and the inner edge of the anterior thoracic spiracle (figs. 47A, *d.s.*; 48).

Antero-lateral angles of thorax rather densely setose; mesepisternum with 13 or 14 discal bristles (fig. 47B). *Female:* Terminal cone with four apical macrosetae (fig. 51B). *Male:* Gonapophyses (lateral view) abruptly tapered apically. Hosts: *Pteronotus psilotis, P. suapurensis* ....*fairchildi* n.sp.

3. Each lateral lobe of tergum II with two large and one much shorter spinelets on posterior margin plus nine or ten other setae. Postgenae with two or three minute spinelets. *Male:* Paired dorsal connexival setae on abdominal segments III–V conspicuous (fig. 50A). Host: *Natalus stramineus mexicanus*....*natali* n.sp.

Each lateral lobe of tergum II with six to eight setae in addition to the posterior spinelets. Postgenae with four or five minute spinelets. *Male:* Paired dorsal connexival setae on segments III–V very fine, short, inconspicuous (fig. 50B). Hosts: *Macrotus mexicanus, M. californicus*. ....*coxata Ferris*

Nycterophilia parnelli Wenzel, new species. Figs. 45A, 46, 47A, 49A, 51C.

Nycterophilia coxata (not Ferris, 1916), Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 13 (part.). Jobling, 1949 (part.), Parasitology, **39**: 316 ff., 327. Bequaert 1940, Rev. Acad. Colomb. Cien. Ex. Fis. y. Nat., **3**: 418.

Closely related to *fairchildi* n. sp., and like it having a short metacoxal spur, but differing in thoracic chaetotaxy (fig. 47A), in that the female has only two (instead of four) apical macrosetae on the terminal cone and lacks a row of ventral abdominal spiniform setae anterior to the vulva, and the male gonapophyses are strongly but rather evenly tapered from base to apex (lateral view).

DESCRIPTION: *Head.*—Eyes conspicuous, pigmented. Laterovertices with 10–11 setae of variable size, two or three pairs conspicuously longer than the others though they are not macrosetae; occiput with a pair of dorsal macrosetae on each side; posterior margins of head on each side with a vertical row of seven to nine short, distinct setae; side of head with a transverse row of five to seven short setae across middle; three or four postgenal spinelets present. *Thorax.*—Mesonotum covered dorsally with short setae. Chaetotaxy of sides as shown in fig. 47A. Scutum with six prominent setae anteriorly, consisting of two on each side and a median pair; the latter followed posteriorly by a median pair of shorter setae; scutellum with a median pair of closely appressed, often partially fused very long prominent macrosetae that arise from the same theca; lateral to the scutellum a macroseta and a short seta on each side. *Wings.*—As in *N. coxata. Legs.*—Profemora with five macrosetae alternating with short setae on upper margin; outer face with dorsal submarginal and numerous discal setae arranged in irregular longitudinal rows, inner face with three peg-like spines above, two of them more slender and situated near middle, a longer one near apical third; a ventral submarginal spinelet near base; a large curved blunt spine above margin near middle and a short weak spinelet basal to it. Protibiae feebly tapered apically; incrassations of the margin not strong; in addition to marginal and submarginal setae of outer face there is a median longitudinal row, the uppermost setae of this row strong, coarse. Metacoxa with a short inconspicuous dorsal spur (fig. 47A). Other tibiae and tarsi very similar to those of *N. coxata.*

Abdomen.—Female: Tergum I with two setae, one above the other, along middle of antero-lateral face; posterior margin with short fine setae. Tergum II at middle of posterior margin with four very slender long setae, two on each side; lateral lobes with two large stout spiniform setae at posterior margin, a shorter spiniform above them and fine setae anterior to these. Dorsal connexivum bare except as follows: segments III–V represented dorsally by paired macrosetae, those of VI and tergum VII shorter; III represented by two pairs, these "connected" to setae of lateral connexivum on each side by a row of setae slightly anterior to them; tergum VII small, feebly sclerotized, with four setae. Terminal cone with a single pair of dorso-apical macrosetae and ventral to these about eight setae of varying lengths, one of these (antero-median) much longer than the others. Posterior margin of sternum I with a median ventral pair of strong setae and dorsally with a row of setae, the more ventral ones very fine and short, the

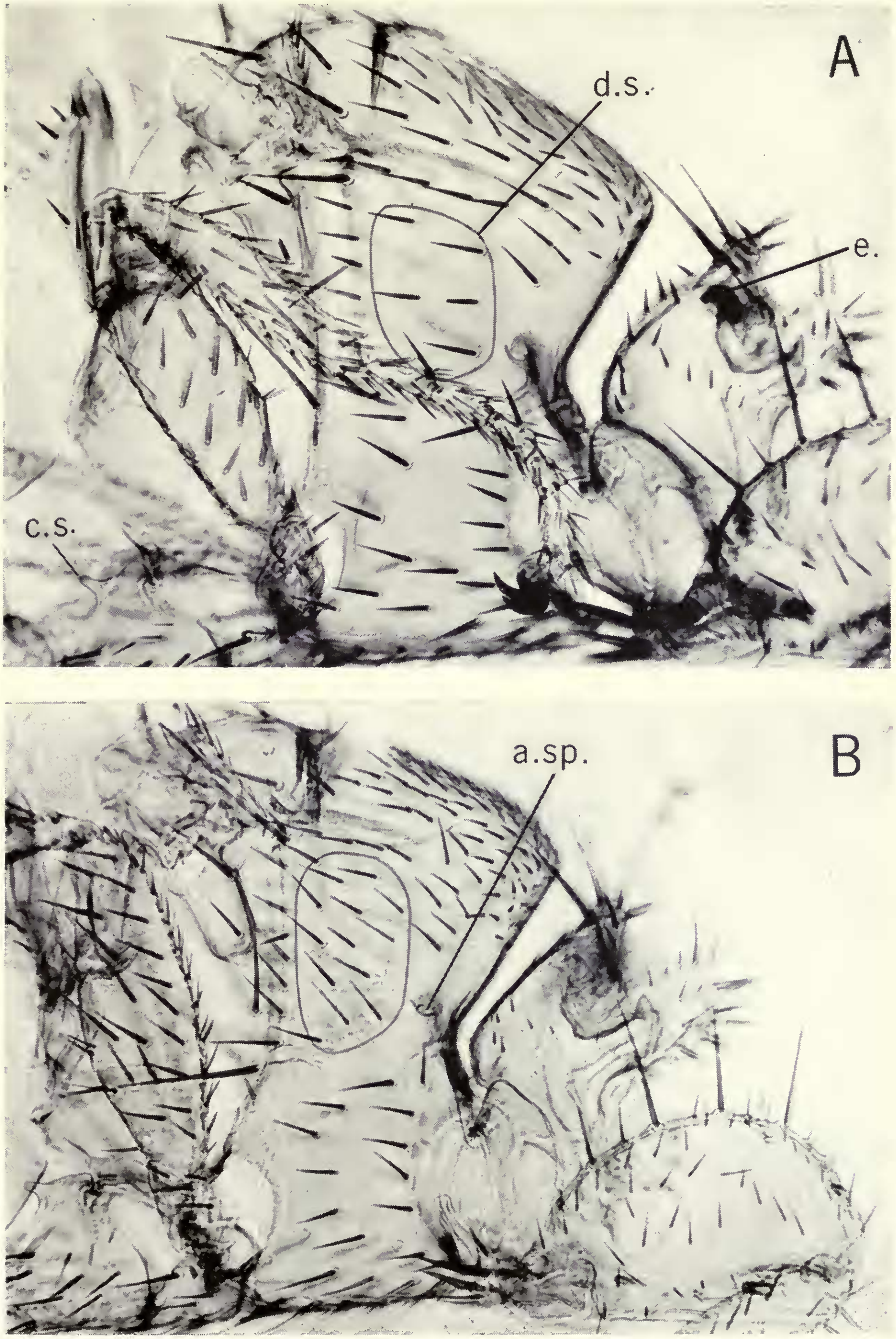

Fig. 47. Head and thorax, lateral view. A, *Nycterophilia parnelli*, new species, female paratype from *Pteronotus parnellii fuscus* (no. 7167), Madden Airstrip (Panamá). B, *N. fairchildi*, new species, female paratype from *Pteronotus suapurensis* (no. 8777), Penonomé Caves (Coclé). See text for explanation.

setae becoming coarse, "braided", dorsally. Posterior margin of sternum II with braided setae, these becoming longer, stout and braided and similar to the connexival setae dorsally; ventro-median edge of sternum V with a fringe of somewhat longer setae; VI bare and connected with VII+VIII along ventral midline.

Measurements:	BL	TL	WL	WW
Male	1.35–1.40	0.42–0.46	1.15–1.32	0.55–0.58
Female	1.42–1.65	0.44	1.21–1.32	0.60–0.66

TYPE MATERIAL: Holotype male and allotype female (slides) from *Pteronotus parnellii fuscus* (host no. 3924), railroad culvert, Paraíso (Canal Zone), C. M. Keenan and V. J. Tipton, 24 July 1959. In the collection of Chicago Natural History Museum.

Paratypes.—116 specimens (18 lots) all from *Pteronotus parnellii fuscus* as follows: 43 (1 lot), railroad culvert, Paraíso (Canal Zone), 24 July 1959; 8 (6 bats), same locality 15 and 16 September 1959, and 1, same locality, 1 December 1959; 2, railroad culvert east of Summit Golf Club (Canal Zone), 26 October 1959; 12 (1 bat), Madden Air Field, Casa Larga (Panamá), 23 May 1961; 12, Chilibrillo Caves (Panamá), L. H. Dunn no. 271 [MCZ]; 3, same locality (labeled as from "*Chilonycteris r. rubiginosa*") [CU]; 3 (3 bats), Guánico (Los Santos), 22 January and 16 February 1962; 1, Cerro Hoya (Los Santos), 14 February 1962; 7, Penonomé (Coclé), L. H. Dunn [MCZ]; 26, same locality, in cave, 11 March 1954, H. Trapido. Paratypes to be deposited in the collections listed on p. 410.

OTHER MATERIAL EXAMINED: From *Carollia perspicillata azteca* (!): 2, Buena Vista (Colón), 3 September 1959; 2 (from preserved bats in museum collection), Chilibrillo Caves (Panamá), 30 August 1935. In addition, we have seen numerous specimens which we tentatively assign to this species, from various hosts, taken in MEXICO, GUATEMALA, VENEZUELA, and TRINIDAD.

Nycterophilia fairchildi Wenzel, new species. Figures 47B, 49B, 51B.

? *Nycterophilia coxata* (not Ferris, 1916), Pessôa and Guimarães, 1940, Arq. Inst. Biol., 11: 421.

Very similar to *N. parnelli* n. sp. and, like it, with a short inconspicuous dorso-apical spur on metacoxa; differing conspicuously from it in the thoracic chaetotaxy (fig. 47B); in that the female has four (instead of two) apical macrosetae on the terminal cone and has a ventral transverse row of about eight heavy spiniform setae anterior to the vulva; and in that the male gonapophyses are broad at base and abruptly tapered apically (in lateral view).

DESCRIPTION: Very similar to *parnelli* in most characters. *Head.*—With three post genal spinelets. *Thorax.*—Chaetotaxy as in fig. 47B. *Wings and legs.*—As in *parnelli. Abdomen.—Female:* Lateral lobes of tergum II with eight setae in addition to the three coarse marginal spiniform setae. Chaetotaxy of dorsal connexivum very similar to that of *parnelli,* except that setae of segment VI are lacking; the setae on III are connected to lateral connexival setae by a group of five or six setae on each side. Terminal cone with four apical macrosetae (two each side) and five or six other setae on each side. Sterna I and II similar to those of *parnelli,* the lateral disc of II with a row of three to five setae in addition to the setae along posterior margin. Seventh sternites with about 12 setae, of which the ventral and dorso-apical ones are macrosetae, the others of varying lengths. Anterior to the vulva (ventral and between the seventh sternites) is a trans-

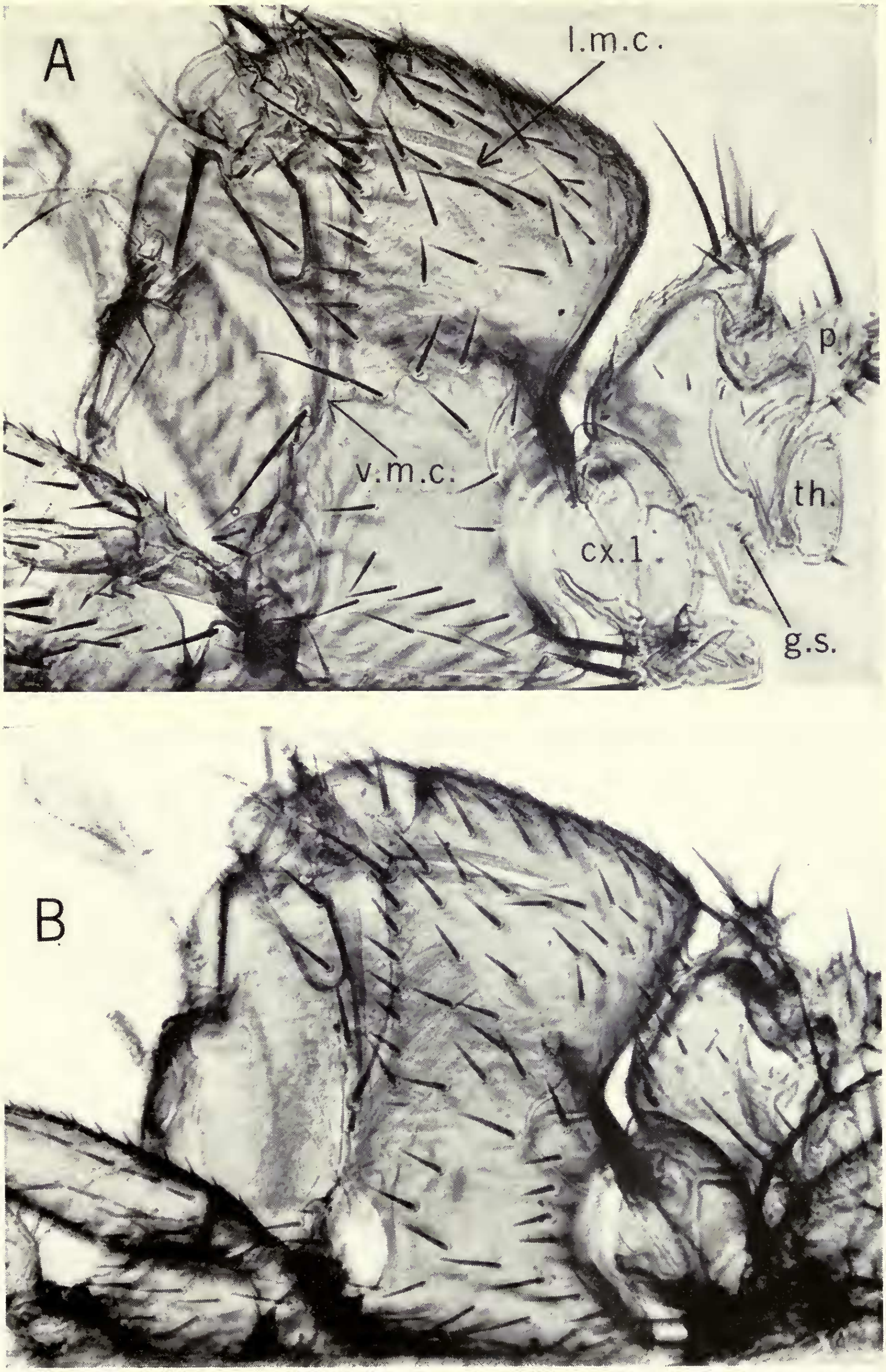

Fig. 48. Head and thorax, lateral view. A, *Nycterophilia natali*, new species, female from *Natalus* sp. (CNHM host nos. 64731–807), Santa Clara, Sierra de las Minas (Zacapa), GUATEMALA. B, *N. coxata* Ferris, from *Macrotus mexicanus*, La Galarza (Puebla), MEXICO. See text for explanation.

verse sclerotized strip which bears a row of eight conspicuous spiniform setae, four on each side appearing somewhat like a ctenidium. *Male:* Lateral lobes of tergum II each with 9–11 setae in addition to the very heavy spiniform setae on posterior margin. Dorsal connexivum bare except for very fine, very short paired segmental setae on III–IV. Sternum VII+VIII with about 13 or 14 setae on each side. Upper portion of segment IX with about 14 setae in addition to the stout dorsal macroseta; shaft of claspers typically with a row of five, sometimes four, setae; harpago with a long basal ventral seta, a short very fine sub-basal dorsal seta, two short setae at about basal third, two very fine distal ventral setae and some apical microsetae that are visible only under oil immersion. Gonapophyses strongly but rather evenly tapered from base to apex.

Measurements:	BL	TL	WL	WW
Male	1.37	0.44	1.13–1.15	0.55–0.60
Female	1.59	0.47	1.29	0.55

TYPE MATERIAL: Holotype male and allotype female (slides) from *Pteronotus suapurensis* (host no. 8777), Penonomé Caves (Coclé), 15 December 1961, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—From *Pteronotus suapurensis:* 9 (3 bats), same data as the holotype; 6, no locality (CBK host no. 5014), 2 May 1957 [USNM]. From *Pteronotus psilotis:* 4 (3 bats), same locality, collectors and date as holotype; and 1, same data but 24 January 1962. From *Pteronotus* sp.: 58, same locality as holotype, 11 March 1954, H. Trapido. From "*Pteronotus davyi*": 3, same locality, without date, L. H. Dunn [MCZ]. Non-Panamanian paratypes.—From *Pteronotus personatus:* 47, Cartagena, COLOMBIA, 22 June 1965, C. J. Marinkelle. Paratypes to be deposited in the collections listed on p. 410, and in the collection of C. J. Marinkelle, Universidad de los Andes, Bogota, Colombia.

OTHER MATERIAL EXAMINED: We have seen additional specimens, which we tentatively assign to this species, from MEXICO, GUATEMALA, and VENEZUELA.

REMARKS: To our knowledge, *Pteronotus davyi,* listed as a host for the specimens collected by Dunn [MCZ], does not occur in Panama.

N. fairchildi is named in honor of Dr. Graham B. Fairchild of the Gorgas Memorial Laboratory, Panamá, Panamá.

Nycterophilia natali Wenzel, new species. Figures 48A, 50A.

Nycterophilia coxata (not Ferris, 1916), Hoffmann, 1953 (part.), Mem. Congr. Cient. Mex., 7: 183, 187.

N. natali n. sp. differs from both *fairchildi* and *parnelli* in that it has a conspicuous long (rather than a short) dorsal metacoxal spur. In this respect, it resembles *N. coxata.* However, the male holotype differs from *coxata* in that the pairs of dorsal segmental connexival setae on III–V are conspicuous rather than very fine and short; and the "harpago" of the male terminalia lacks a long, conspicuous, ventral, basal seta. *N. natali* also differs from *coxata* in the number of postgenal spinelets and in the number of setae on the lateral lobes of abdominal tergum II, as indicated in the key.

In addition to characters *natali* has in common with *fairchildi, parnelli,* and *coxata,* the following may be noted:

DESCRIPTION: *Head.*—Setae of posterior margin of head finer and shorter than in *fairchildi* and *parnelli;* three or four postgenal spinelets present. *Thorax.*—Ventral

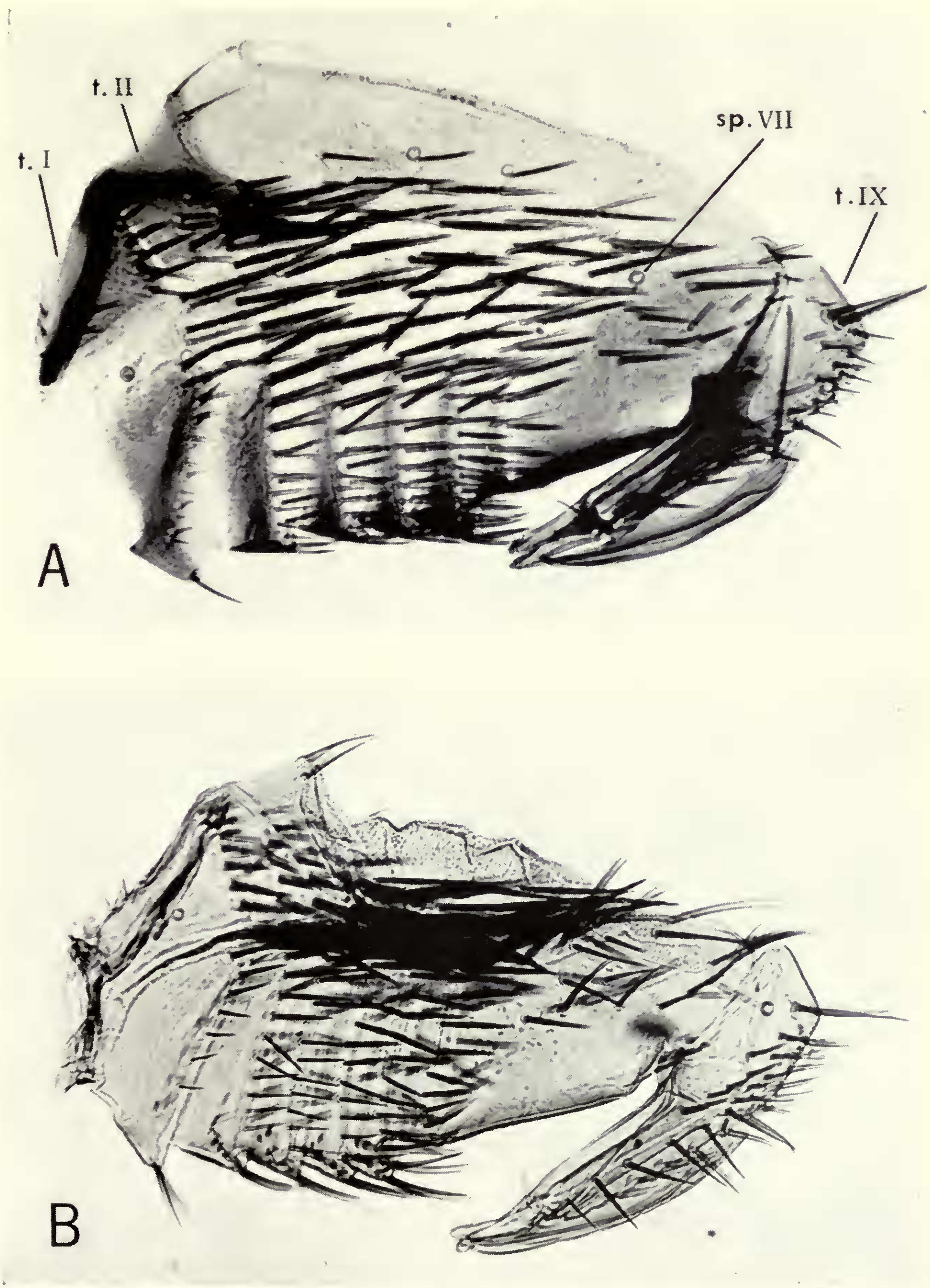

Fig. 49. Male abdomen. A, *Nycterophilia parnelli* new species, paratype from *Pteronotus parnellii fuscus* (no. 7167). B, *N. fairchildi,* new species, paratype from *Pteronotus suapurensis* (no. 8777). See text for explanation.

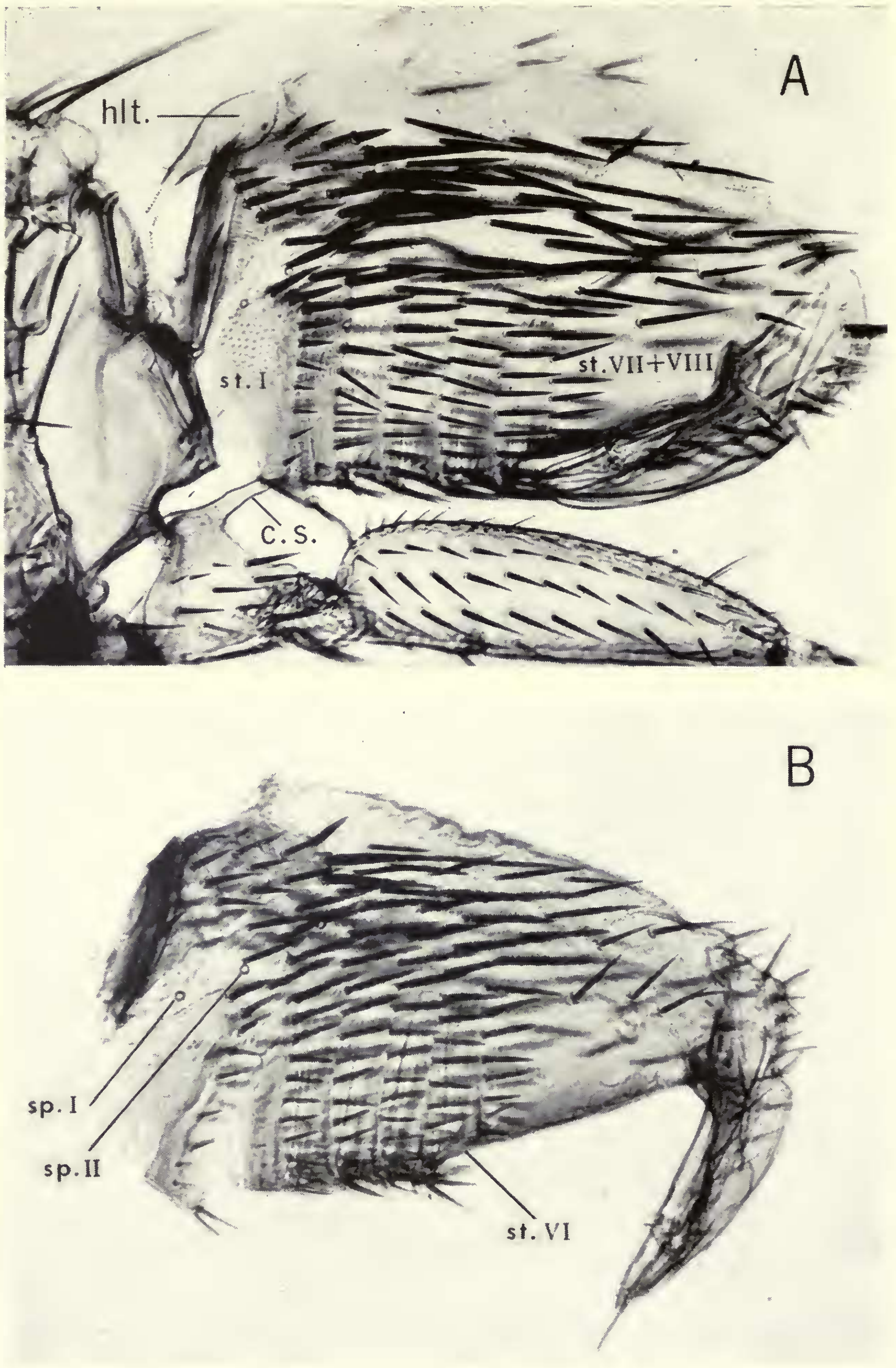

Fig. 50. Male abdomen, lateral view. A, *Nycterophilia natali*, new species, holotype. B, *N. coxata* Ferris (same specimen as 48B).

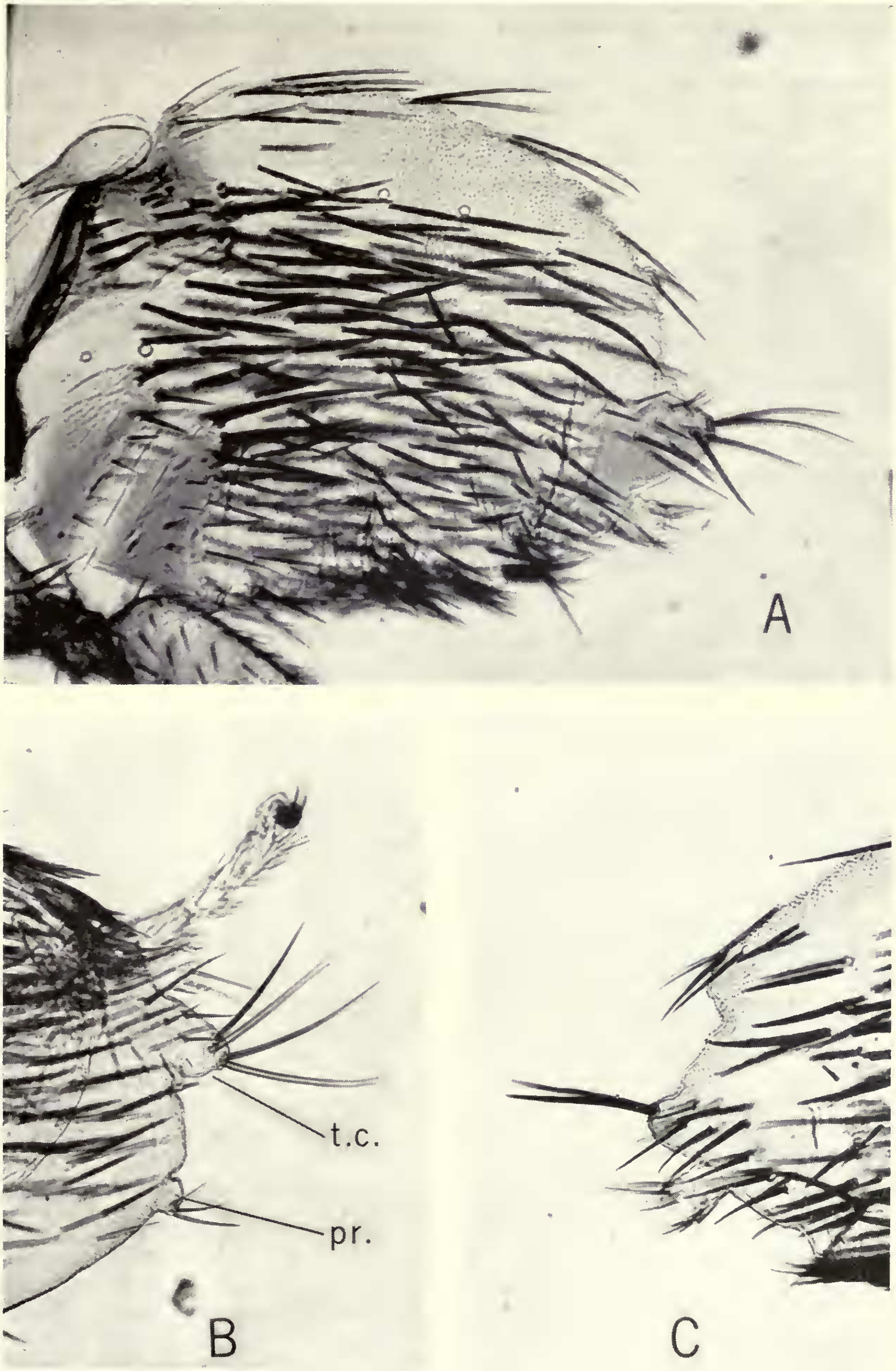

Fig. 51. Female abdomen, lateral view. A, *Nycterophilia coxata* Ferris, from *Leptonycteris nivalis*, Pima County, Arizona. B, *N. fairchildi*, new species, from *Pteronotus suapurensis* (no. 8777). C, *N. parnelli*, new species, from *Pteronotus parnellii fuscus* (no. 7167). See text for explanation.

setae of procoxae spine-like. Lateral lobes of tergum II with the usual heavy spine-like setae on posterior margin, and anterior to these, nine additional setae. Segmentally arranged dorsal pairs of connexival setae on segments III–V moderately long, conspicuous. Hypopygial "ring" with eight setae on each side. Segment IX on each side above the ventral shaft, with nine or ten setae in addition to the dorso-apical macroseta; shaft with four setae along posterior edge; harpago without a long ventral basal seta, but with a fine rather short sub-basal seta dorsally and another ventrally, as well as microsetae on apical half of inner and dorsal margins.

Measurements:	BL	TL	WL	WW
Male (Holotype)	1.32	0.44	1.21	——
Female (GUATEMALA and MEXICO)	1.52	0.47–0.48	1.36	0.66

TYPE MATERIAL: Holotype male (slide) from *Natalus stramineus mexicanus* (host no. 6732), San Lorenzo Caves, Fort San Lorenzo (Canal Zone), 15 March 1961, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

OTHER MATERIAL EXAMINED: We have several specimens that appear to be *natali,* taken from *Natalus* sp. in Guatemala and Mexico. However, the *Trichobius* from *Natalus s. mexicanus* in Panama appears to be different from that (*galei*) taken from the same host in Guatemala and it is possible that the *Nycterophilia* may be different, too. This may be easier to determine when series of both sexes are known from both localities.

REMARKS: The females from Guatemala differ from those of *coxata* in the characters noted above. On the ventral margin anterior to the vulva there is a row of coarse setae set somewhat apart from the others. These may be homologous to the spiniform setae borne on a sclerotized strip in *fairchildi* n. sp.

Subfamily **Trichobiinae**

Genus **Trichobius** Gervais

Trichobius Gervais, 1844, Atlas. Zool., p. 14, pl. 53. Speiser, 1900, Arch. Naturg., 66A, Bd. I, pp. 62 (cit.), 65 (key), 33–37 (notes on morph.). Brues, 1904, Bull. Amer. Mus. Nat. Hist., 20: 131–134. Coquillet, 1910, Proc. U. S. Nat. Mus., 37: 616. Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Veter., Nictheroy, 5: 25 (keyed), 26–28 (cit., records). Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 12 (keyed), 14–18 (synopsis). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 655. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479 (keyed); Bull. Amer. Mus. Nat. Hist., 66: 522 (keyed); 1935, Amer. Mus. Novit., no. 765, p. 6. Jobling, 1936, Parasitology, 28: 357 ff. (morph., syst. pos.). Guimarães, 1937, Rev. Mus. Paul., 23: 653–666, 2 pls., (S. Am. spp.). Jobling, 1938, loc. cit., 30: 358–387, figs. 1–14 (revision of species). Bequaert, 1940, Rev. Acad. Colomb. Cien. Exact., Fis. y Nat., 3: 417 (keyed); 1942, Bol. Ent. Venez., 1: 86 (keyed), 87–88 (records, Venezuela). Schuurmans Stekhoven Jr., 1941 (& 1951), Beitr. Fauna Perus, 2: 95 (Peruvian species). Jobling, 1949, loc. cit., 39: 321 (keyed), 326 (records, Trinidad spp.). Hoffmann, 1953, Mem. Congr. Cient. Mex., 7: 178 (keyed), 179–182 (key, Mexican spp.), 182–183 (records, Mexican spp.). Maa, 1965, Jour. Med. Ent., 1: 384 (list of spp.)

Trichobius Townsend, 1891 [with *dugesii* Townsend as type-species], Ent. News, 2: 105–106. Williston, 1896, Man. Fam. Gen. N. Am. Dipt., 2nd ed., p. 152 (keyed).

Trichobia Guérin-Meneville, 1844, Icon. Régne Anim., 3: 556. Bigot, 1885, Ann. Soc. Ent. Fr., 5: 228.

Strebla Kolenati, 1863, Hor. Soc. Ent. Ross., 2: 11 (not Wiedemann, 1824).

Kolenatia Rondani, 1878, Ann. Mus. Civ. Stor. Nat. Genova, **12**: 169 [type-species: *Strebla wiedemannii* Kolenati 1863, not Kolenati 1856]. Bigot, 1885, Ann. Soc. Ent. Fr., (6), **5**: 232 (keyed). Speiser, 1900, Arch. Naturg., **66A**, Bd. I, pp. 33, 43 (synonymizes *Kolenatia* under *Trichobius*).

Kesselia Curran, 1934, Bull. Amer. Mus. Nat. Hist., **66**: 522 [type-species: *Kesselia pallida* Curran]; 1935, Amer. Mus. Novit., no. 765, p. 5 (keyed). Jobling, 1936, Parasitology, **28**: 359 (venation).

Type-species: *Trichobius parasiticus* Gervais, 1844.

Seventeen previously described species of this genus are considered by us to be valid. One of these is assigned to a new genus, *Trichobioides*. Twenty-seven species are treated in this paper. Of these, six previously described and 17 new species are recorded from Panama. *T. caecus* Edwards and *T. furmani* n. sp. are included, in order to assist in defining closely related Panamanian species. *T. pallidus* Curran (in key) and *T. diphyllae* n. sp. are included, because their hosts have been taken in Panama and the flies may also be found there.

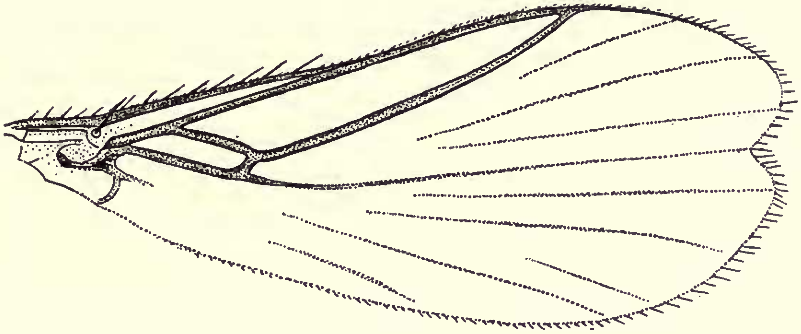

Fig. 52. Wing, *Nycterophilia* sp. From Jobling (1949b).

The new species treated below bring the total number of described species of *Trichobius* to 34, making it the largest new world genus of Streblidae. In the collections of Chicago Natural History Museum, there are about a dozen additional species. Undoubtedly, many more will be discovered.

The genus includes diverse types, representing at least six, and possibly more, groups or species complexes. In the *major* group, we include *T. major* Coquillet, *hirsutulus* Bequaert, *corynorhini* Cockerell, *pseudotruncatus* Jobling, *sparsus* Kessel, and several undescribed species from Central America and the West Indies; *T. sphaeronotus* Jobling and *truncatus* Kessel appear to belong here. The species of the *major* group occur primarily on Vespertilionidae, though one may occur secondarily on Molossidae of the genus *Tadarida*. *T. sphaeronotus* occurs on *Leptonycteris*, a genus of Glossophaginae (Phyllostomidae).

The *caecus* group includes *T. caecus* Edwards, three new species described below, and several additional undescribed species. All occur on bats of the families Natalidae and Chilonycteridae.

T. pallidus Curran, which was taken on *Furipterus* (Furipteridae) superficially appears to be related to species of the *caecus* group. However, it differs in several essential features and until a series can be studied in detail, we would place this species by itself. Two undescribed species from Peru, one from a furipterid (*Amorphochilus schnablii*), seem to be related to *pallidus* but have a simple median suture.

The relationships of *T. adamsi* Augustson are not clear. It may be a specialized member of the *major* group.

The species of the *phyllostomae* group, including *T. phyllostomae* Kessel, *T. brennani* n. sp., *T. vampyropis* n. sp. and an undescribed species from Brazil occur on fruit-eating bats of the subfamily Stenoderminae (including Sturnirinae of authors).

Most of the remaining described species belong to the related *dugesii* and *longipes* groups. The species of the *longipes* group occur mostly on Phyllostominae of the genera *Phyllostomus* and *Tonatia,* although *T. dunni* n. sp. and several related undescribed species are apparently restricted to bats of the genus *Molossus.* The species of the *dugesii* complex are apparently mostly specialized types derived from species of the *longipes* complex and have radiated from the Phyllostominae to the Stenoderminae, Carolliinae, Glossophaginae and Desmodidae.

KEY TO PANAMANIAN SPECIES OF *TRICHOBIUS*[8]

1. Sixth longitudinal vein without setae near basal angle (fig. 42) 2
Sixth longitudinal with setae at or near basal angle (fig. 61) 7

2. Median suture of prescutum bifurcate, short (fig. 56) 3
Median suture not bifurcate, usually extending to middle of prescutum or beyond 10

3. Eyes with a single facet 4
Eyes with more than one facet .... *pallidus* Curran

4. A broad median area of mesonotum without micropile; scutum at middle with only three transverse rows of bristles, including the antescutellars (fig. 54). Wing vein R_s twice as long as distance between fork and crossvein *r-m. Female:* Postgenital sclerite as in fig. 57K; seventh sternites with macrosetae along posterior margin, most discal setae well-developed; chaetotaxy of terminal cone as in fig. 57J. *Male:* Hypopygium with long, sparse setae dorsally and apically. Gonapophyses strongly curved, apices at approximately a right angle to base (fig. 57L). Host: *Natalus stramineus mexicanus* .... *galei* n. sp.
Mesonotum and scutellum with micropile throughout; scutum at middle with about four transverse rows of bristles including the antescutellars (fig. 56A). R_s slightly to no more than a third longer than distance between fork and crossvein *r-m. Female:* Seventh sternites each with only three to five macrosetae along posterior margin, the rest of the setae small to minute. *Male:* Setae of hypopygium short except along apical margin. 5

5. Chaetotaxy of lateral lobes of tergum I+II as in fig. 55A. *Female:* Postgenital sclerite as in fig. 57H; seventh sternites usually with three, sometimes four, macrosetae. Chaetotaxy of terminal cone as in fig. 57G. *Male:* Gonapophyses as in fig. 57I. Hosts: *Pteronotus suapurensis, P. psilotis* .... *johnsonae* n. sp.
Chaetotaxy of lateral lobes of tergum I+II as in fig. 55B. Host: *Pteronotus parnellii fuscus* 6

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[8] Two of the included species, *T. pallidus* Curran and *T. diphyllae* n. sp. have not been recorded from Panama but may occur there. Two others, *T. caecus* Edwards and *T. furmani* n. sp., are included in the key in order to assist in differentiating between some closely related species that occur in Panama.

6. *Female:* Inner pair of basal setae on tergum VII absent or very small (fig. 57A); seventh sternites each with three or four macrosetae near apical margin; subgenital sclerite as in fig. 57B. *Male:* Gonapophyses as in fig. 57C. ....*caecus* Edwards

   Female: The inner pair of basal setae on tergum VII well developed (fig. 57D); each seventh sternite usually with five or more macrosetae along apical margin; postgenital sclerite as in fig. 57E. *Male:* Gonapophyses as in fig. 57F. ....*yunkeri* n. sp.

7.[9] Wing vein R_1 strongly sinuate, the costal cell rather abruptly narrowed apically (fig. 59A); R_s markedly longer than distance between fork and crossvein *r-m*, and the latter distance no more than twice the length of *r-m*. *Female:* With a distinct cluster of longer discal setae in posterior angles of sternum II. *Male:* Gonapophyses (fig. 60D), wedge-shaped in lateral view, ventral margin nearly straight, with a submarginal row of fine setae. ....*lonchophyllae* n. sp.

   Wing vein R_1 straight or only very feebly sinuate (fig. 61), the costal cell rather evenly tapered or nearly subparallel apically; length of R_s and distance between fork and crossvein *r-m* subequal, the latter distance more than twice the length of *r-m*. *Female:* Marginal setae of sternum II longer toward posterior angles but discal setae not longer within the angles. *Male:* Gonapophyses (figs. 60A–C) ventrally curved and tapered, at most with one or two submarginal setae along ventral margin 8

8. Posterior margin of each occipital plate with a prominent posteriorly-directed tubercle which bears a very short spinelet-like seta; eyes separated by their width or more from lateral margin of head. *Male:* Gonapophyses as in fig. 60C. ....*uniformis* Curran

   Posterior margin of each occipital plate with a short seta borne on an inconspicuous tubercle, the seta not a spinelet; eyes extending to lateral margins of head or separated from margins by less than their width. 9

9. *Female:* Four setae of tergum VII arranged in a transverse row. *Male:* Gonapophyses as in fig. 60A. Hosts: *Micronycteris megalotis, M. nicefori* ....*keenani* n. sp.

   Female: Four setae of tergum VII arranged one pair behind the other, the anterior and posterior pairs widely separated. *Male:* Gonapophyses as in fig. 60B. Host: *Lionycteris spurrellii* ....*lionycteridis* n. sp.

10. Scutum and prescutum covered with setae 13

    Scutum and prescutum with conspicuous areas devoid of setae (figs. 58B, 67B, 73B) 11

11. Prescutum with a longitudinal cluster of six to nine very short setae at middle anterior to the transverse suture (fig. 67B). Hosts: *Phyllostomus* spp. ....*costalimai* Guimarães

    Prescutum without such a cluster of setae....................................12

12. Size smaller, body 1.36–1.70 mm. long. Thorax distinctly flattened; prescutum with a transverse row of setae immediately anterior to transverse mesonotal suture and a median group of four to six setae, these sometimes separated from a lateral group on each side (fig. 73A); W-shaped band of setae along posterior margin of scutum consisting of very short setae only. Hosts: *Desmodus rotundus, Diaemus youngii*...............................*parasiticus* Gervais

    Size larger, body 1.65–2.25 mm. long. Thorax deeper, not flattened; row of setae anterior to transverse mesonotal suture broadly interrupted at middle (fig. 58B); band of setae along posterior margin of scutum with a row of very long antescutellar setae and anterior to these a transverse patch of very short setae. Host: *Pteronotus parnellii fuscus* ....*sparsus* Kessel

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[9] The species of the *uniformis* group are extremely difficult to identify without comparative material, except by the structure of the male gonapophyses.

13. Sternopleura strongly projecting between the procoxae; lateral margins of the projection subparallel apically (fig. 62D) 14

    Sternopleura less strongly projecting between the coxae, the lateral margins oblique (fig. 62E) 15

14. Size larger, body 2.20–2.65 mm. long. Prescutum two-thirds as long as broad, the anterior margin very strongly projecting at middle; mesonotal chaetotaxy as in fig. 74B. Wing vein R_s about as long as distance between fork and crossvein *r-m*. Host: *Vampyrops vittatus* .... *vampyropis* n. sp.

    Size smaller, body 2.09–2.39 mm. long. Prescutum only slightly more than half as long as broad, the anterior margin projecting but less strongly so; mesonotal chaetotaxy as in fig. 74A. Wing vein R_s only slightly more than half as long as distance between fork and crossvein *r-m*. Host: *Sturnira ludovici* .... *brennani* n. sp.

15. Occipital lobes of head with 10–12 setae. Abdominal tergum I+II with a cluster of short setae on each side of middle of basal margin, a group of coarse long setae on lateral lobes, and a single seta (occasionally two) on anterior face, situated laterally and ventrally to median basal group 16

    Occipital lobes of head with 17–19 setae. Abdominal tergum I+II with a cluster of about 10 short setae on anterior face on each side lateral and ventral to median basal cluster .... *dunni* n. sp.

16. Median pleurotrochantinal lobe present, reflexed dorsally and united with a descending process of the metepimeron so as to close the coxal cavities mesally (fig. 62A) 17

    Median pleurotrochantinal lobe absent, or if one is present and reflexed, it is not united with the metepimeron so as to close the coxal cavities (figs. 62B, C) 20

17. Median anterior prescutal setae of about the same size as those along sides, and longer than median discal setae (fig. 66A); prescutum with a distinct patch of micropile on each side in front of transverse suture, the patch extending mesad to or slightly beyond the second seta from lateral margin and anteriorly to second seta from transverse suture. *Male:* Gonapophyses as in fig. 63A. Host: *Tonatia minuta* .... *bequaerti* n. sp.

    Median anterior prescutal setae distinctly shorter than lateral setae, often only slightly longer, if any, than dense short median discal setae (figs. 64, 65); scutum with a very narrow longitudinal band of micropile along inner margin of longitudinal membranous cleft, scarcely entering upon disk, if at all 18

18. Prescutal setae noticeably and rather abruptly denser on basal half of median discal area than they are laterally and anteriorly (figs. 64, 65B) 19

    Prescutal setae gradually sparser anteriorly and laterally (fig. 65A). *Male:* Gonapophyses as in fig. 62B. Host: *Tonatia silvicola* .... *dybasi* n. sp.

19. Size larger, 1.76–2.35 mm. long. Genal-postgenal margins rather strongly convergent posteriorly. *Male:* Gonapophyses as in fig. 63F. Host: chiefly *Phyllostomus hastatus* .... *longipes* Rudow

    Size smaller, 1.59–1.73 mm. long. Genal-postgenal margins subparallel or feebly convergent for part of their length, then broadly rounded apically. *Male:* Gonapophyses as in fig. 63D. Host: *Tonatia minuta* .... *mendezi* n. sp.

20. Pleurotrochantinal lobe present (fig. 62B), this usually rounded, translucent, and feebly reflexed dorsally, though it may be long and strongly reflexed and superficially appear to unite with a ventrally directed spiniform process of the metepimeron. *Male:* Sternum VI present (except in *macrophylli*) 23

    Posterior margin of pleurotrochantines without a median lobe (fig. 62C). *Male:* Sternum VI absent 21

21. Median discal mesonotal setae extremely minute and fine, sometimes almost indistinguishable except in slide preparations at high magnification (fig. 73B). Host: *Diphylla ecaudata* .... *diphyllae* n. sp.

    Median discal mesonotal setae very distinct, easily visible even if minute. 22

22. Mesonotal setae gradually becoming longer posteriorly, the median antescutellar setae no more than twice as long as those immediately anterior to them (fig. 71). *Male:* Gonapophyses with scattered thorn-like setae (fig. 68D) ....*dugesioides* n. sp.
   Median setae of antescutellar row three to four times as long as the mesonotal setae anterior to them (fig. 72). *Male:* Gonapophyses with fine normal setae (fig. 68C). Host doubtful. ....*furmani* n. sp.
23. Median setae of antescutellar row scarcely longer than the discal scutal setae anterior to them (fig. 69) 24
   Median setae of antescutellar row distinctly longer than the scutal setae anterior to them (figs. 66B, 70) 25
24. Prescutal setae rather evenly distributed and becoming gradually longer laterally and anteriorly, the minute discal setae extending anteriorly beyond the middle (fig. 69B). *Male:* Sternum VI absent. Host: *Macrophyllum macrophyllum* ....*macrophylli* n. sp.
   Prescutal setae becoming rather abruptly longer laterally and anteriorly, the median discal area of denser minute setae extending to about middle (fig. 69A). *Male:* Sternum VI present. Host: *Glossophaga soricina* ....*dugesii* Townsend
25. Size larger, 1.46–2.17 mm. long. Antero-lateral setae of prescutum very long (fig. 66B). *Male:* Apices of gonapophyses distinctly curved ventrally (fig. 68I). Host: *Uroderma bilobatum* ....*urodermae* n. sp.
   Size smaller, 1.21–1.7 mm. long. Antero-lateral setae of mesoprescutum long but not unusually so. *Male:* Gonapophyses (lateral view) nearly straight apically (fig. 68E). Hosts: Chiefly *Carollia* spp., ...*joblingi* n. sp.

Trichobius pallidus group

This group contains a single described species, *T. pallidus,* from British Guiana, taken from *Furipterus horrens* (fam. Furipteridae). Two apparently related, undescribed species are known to us from South America. One is from *Amorphochilus schnablii,* the only other species and genus of the family Furipteridae. In both of these undescribed species, the median mesonotal suture is simple, not bifurcate. We have seen only a single paratype of *pallidus,* and have not been able to satisfy ourselves that the median suture is truly bifurcate as in the *caecus* group, to which *pallidus* is obviously related. Interestingly, the Furipteridae are regarded as South American relatives of the Natalidae, which like the Chilonycterinae, are hosts of the *caecus* group. The *pallidus* group may be characterized as follows:

With the characters of the *caecus* group but differing in having multi-faceted eyes, the sixth sternum absent in the male, the tarsi shorter with the segments more compressed antero-posteriorly, and in lacking a ventral comb-like scale on the first tarsomere of the hind tarsi.

Trichobius pallidus (Curran). Figure 53.

Kesselia pallida Curran, 1934, Bull. Amer. Mus. Nat. Hist., **66**: 522—Kartabo, British Guiana, ex *Furipterus horrens* (American Museum of Natural History, N. Y.).
Trichobius pallidus, Jobling, 1936, Parasitology, **30**: 365 (keyed), 372 (redescr.), fig. 373; 1949, ibidem, **39**: 317 (host).

This species is known only from the type series, consisting of the holotype and two paratypes, all males. The type host was collected in Panama, and it is possible that *T. pallidus* occurs there, too.

Trichobius caecus group

The species of this group are apparently restricted to the Chilonycterinae (Phyllostomidae) and Natalidae. They probably should be regarded as a separate genus. The group may be characterized as follows:

Head.—Dorsal surface of head not sub-divided into distinct laterovertices and occipital plates; setae of occiput limited to lateral area; eyes a single large facet projecting beyond lateral margins of head. *Thorax.*—High (deep), convex, anterior face oblique in profile, the upper edge projecting anteriorly above insertion of head. Mesonotum convex, the median suture short, bifurcate; anterior margin of prescutum rounded; setae of rather even size and distribution. Anterior margin of sternopleura angulate, feebly produced between the procoxae; posterior margin of pleurotrochantines straight; hind coxae nearly approximate. *Wings.*—Fourth and sixth longitudinal veins without setae near base. *Legs.*—First segment of hind tarsi with a ventral transverse comb-scale, inserted in a groove. *Abdomen.*—*Female:* Median dorsal connexivum not bare along entire mid-length, with at least two or more transverse rows of setae near apex; tergum VII and the "supra-anal plate" incompletely separated. *Male:* Sternum

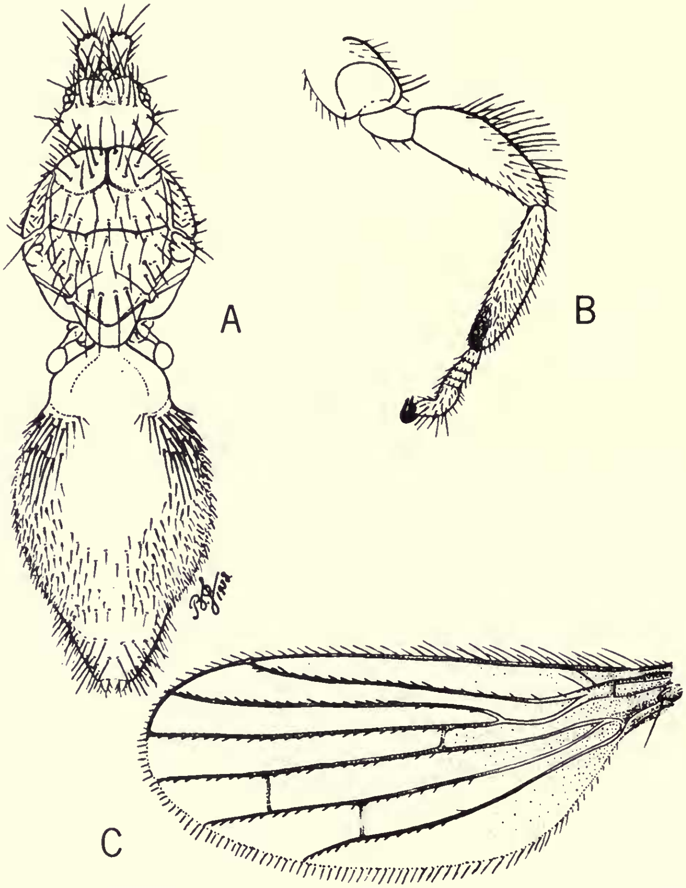

Fig. 53. *Trichobius pallidus* (Curran). A, dorsal view. B, hindleg. C, wing. From Jobling (1938).

V feebly sclerotized, transverse. Sternum VI very well developed, longest at middle and with distinctive marginal and submarginal setae along posterior edge. Gonapophyses symmetrical (in dorsal view), apices curved ventrally (in lateral view), paired ventral setae inserted at same level on each, the accessory seta of each pair situated anterior to the macroseta.

The comb-scale on the first segment of the hind tarsi and the presence of marginal and submarginal setae on sternum VI (male) are characters not found in any other New World Streblidae. A well-developed male sixth sternum does not occur among any other Trichobiinae, but does in the Streblinae, as defined here. It is of interest that the absence of setae along the base of the fourth longitudinal vein is also characteristic of the *caecus* group and of the Streblinae.

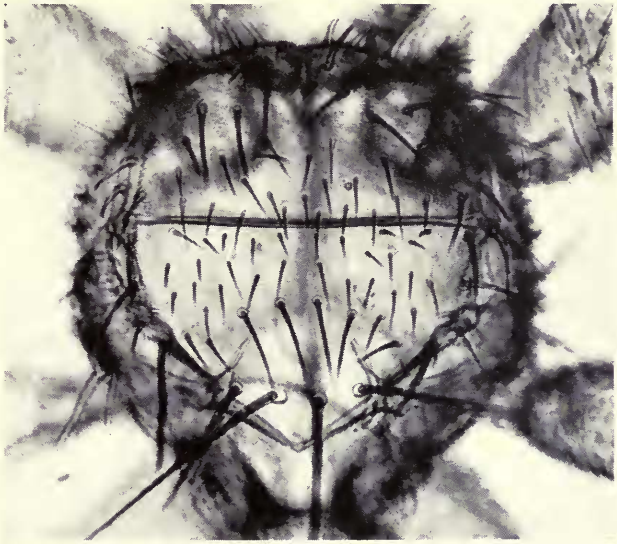

Fig. 54. Thorax, dorsal view, *Trichobius galei*, new species, from *Natalus stramineus mexicanus* (no. 6731), San Lorenzo Caves (Panamá).

Trichobius galei Wenzel, new species. Figures 54, 57J–L.

A small species, easily separated from the others of the group by the presence of only two rows of setae between the antescutellars and the transverse suture, the long, discal bristles on the seventh sternites of the female and on the hypopygium of the male, as well as by the short, very strongly bent male gonapophyses.

DESCRIPTION: In general, with the characters of *T. caecus* excepting as follows: *Thorax.*—Anterior margin of prescutum scarcely projecting at middle, if at all; scutum at middle with only two transverse rows of setae between antescutellars and transverse suture. *Wings.*—R_s bare on basal half or slightly less, at least twice as long as distance from fork to crossvein *r-m*. *Abdomen.*—Lateral lobes of syntergum I+II with 9–13 coarse setae and below these usually several shorter, finer setae. *Female:* Tergum VII with only a pair of macrosetae; supra-anal plate with three much longer, apical macrosetae and a pair of lateral setae (one on each side) which are about as long as those on tergum VII; seventh sternites with all setae well developed, four or more macrosetae near apical margin; postgenital sclerite as in fig. 57K. *Male:* Hypopygium covered with long setae dorsally and apically, with shorter setae ventrally; gonapophyses as in fig. 57L.

Measurements:	BL	TL	WL	WW
Male	1.18–1.30	0.47–0.54	1.04–1.07	0.44–0.52
Female	1.32–1.65	0.48–0.55	1.04–1.37	0.52–0.60

TYPE MATERIAL: Holotype male and allotype female (slides) from *Natalus stramineus mexicanus* (host no. 6731), San Lorenzo Caves, Fort Sherman (Canal Zone), 15 March 1961, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum. Paratypes.—Approximately 107 (27 bats), same data as the holotype. From *Natalus* sp.: 2, Camp Chágres, Madden Dam (Canal Zone), 19 June 1963, GML. Paratypes to be deposited in the collections listed on p. 410.

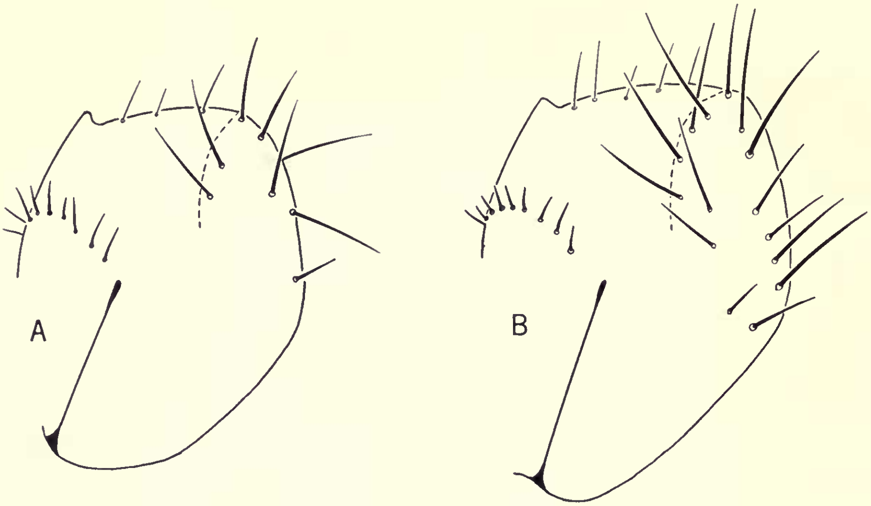

Fig. 55. Lateral lobe of tergum I+II, lateral view. A, *Trichobius johnsonae,* new species. B, *T. caecus* Edwards.

REMARKS: This species is apparently restricted to *Natalus stramineus mexicanus.* A closely related species is known to us from the same host in Guatemala and Mexico. *T. galei* n.sp. is named in honor of Dr. Nathan Gale, Canal Zone Veterinarian.

Trichobius caecus Edwards. Figures 55B, 57A-C.

Trichobius caecus Edwards, 1918, Ann. Mag. Nat. Hist., (9), 1: 424.—Guacharo Caves, Trinidad, from unknown host (British Museum Natural History).—Goodwin and Greenhall, 1961, Bull. Amer. Mus. Nat. Hist., 122: 223.

Trichobius caecus Edwards (part.). Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 14 (keyed), 16 (records). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., no. 155, p. 655. Curran, 1935, Amer. Mus. Novit., no. 765, p. 8 (keyed). Jobling [as *coecus*], 1938, Parasitology, **30**: 371; 1949, ibidem, **39**: 316, 326.

This species is known to us only from Trinidad. Dr. Harold Oldroyd of the British Museum (Natural History) informed us that the type series of *T. caecus* Edwards consists of three female cotypes mounted on one slide and an additional cotype preserved in alcohol. He kindly forwarded the slide containing the three females. The specimens had been mounted in euparol, still soft after many years. The mount was crushed in transit despite very careful packing. Although two of the specimens were obviously in poor condition when mounted and all three suffered some damage, the characters could still be clearly seen. All were remounted in euparol. One, which suffered little damage, was mounted separately on the original slide and has been designated as the lectoholotype. We have not seen the fourth specimen and do not know whether it is a male or female. Our description of the male is based on other Trinidad specimens from Tamana Caves.

Dr. Oldroyd also forwarded to us the specimens which Kessel (1925, p. 16) recorded as *caecus* from *Pteronotus davyi* from Dominica. These specimens, preserved in alcohol, are in extremely poor condition. From specimens we mounted on slides, it is evident that they represent a species very closely related to *T. johnsonae* n. sp., but better preserved and geographically representative samples from *Pteronotus davyi* and related hosts will be needed in order to determine their status.

Dr. B. Jobling (*in litt.*) has informed us that in his revision of the genus *Trichobius* (1938, p. 371) he redescribed *T. caecus* "from two specimens which have been compared with the type of *caecus*. One of these was collected by Dr. L. H. Dunn from '*Chilonycteris rubiginosa rubiginosa*' (= *Pteronotus parnellii fuscus*) in Chilibrillo Caves, Panama, and the other by R. G. Hoves from *Natalus stramineus* in Jamaica." Jobling's illustrations (fig. 56) are obviously of the Panamanian specimen. This is evidenced by the chaetotaxy of the mesonotum and of the apex of the female abdomen, as well as by the host. These correspond with the characters and host of *T. yunkeri* n.sp. Jobling's Jamaican specimen from *Natalus stramineus* is almost certainly *T. galei* n. sp. or a closely related new species. Although Jobling's description of *caecus* seems to be based on both *yunkeri* and *galei* (or a related species), it could for the most part apply equally well to any species of the *caecus* group.

DESCRIPTION: *Head.*—Vertical, dorsal surface elevated in middle; theca pyriform, palpi horizontal; laterovertices and occipital lobes not completely differentiated as separate sclerotized plates, though they are partially separated laterally by a transverse membranous strip; setae of occiput at sides only.

Thorax.—High (deep), the anterior face oblique in lateral view, the upper edge (prescutum) projecting above insertion of head; anterior margin of prescutum rounded, narrowly incised at middle, the median suture short, bifurcate, the transverse suture straight, complete; mesonotal setae rather evenly distributed, the setae much longer anteriorly than posteriorly; scutum with three or four irregular, transverse rows of bristles between the long antescutellars and the transverse suture; scutellar bristles unusually long, the median pair nearly as long as mesonotum. Sternopleura angulate between the front coxae, only feebly produced; pleurotrochantines together relatively narrow, the posterior margin straight, hind coxae nearly approximate. Suture between sternopleura and pleurotrochantines strongly angulate. *Wings.*—Costa and R_1 united at a point midway between second and third crossveins; costa with well-developed macrosetae near base, these gradually smaller apically; fourth and sixth longitudinal veins bare basally; bases of R_1 and fifth longitudinal vein each with three or four macrosetae; R_s only a little longer than distance between fork and crossvein *r-m* (14.5:13). *Legs.*—

Subequal, of moderate length; front tibiae only slightly shorter than the hind tibiae, none of them with macrosetae; basitarsus of hind tarsi nearly twice as long as broad, with a ventral comb-scale.

Abdomen.—Dorsal connexivum with at least two transverse rows of setae near apex, anterior to tergum VII, never completely bare along entire midline, even in gravid females. Lateral lobes of tergum I+II with from 9–11 stout, long bristles and three to five finer, shorter setae below them (lectoholotype with a total of 16 setae). *Female:* Seventh tergum typically with a macroseta on each side and two, rarely four (holotype), short setae between them, these sometimes absent. Supra-anal plate with three apical macrosetae and two pairs of short, lateral setae (one pair each side). Seventh sternites usually with very short setae on outer half (except apical margin), the setae distinctly longer near mesal edge; apical margin with three, sometimes four, macrosetae (lectoholotype with longer setae on outer half on one sternite, as in *yunkeri*). *Male:* Sternum V feebly sclerotized, transverse, not divided, setae uniform throughout. Sternum VI present, relatively long, with a median, rounded bulge, with marginal and submarginal setae along posterior edge; dorsal surface of hypopygium with short, dense setae, these somewhat longer laterally and ventrally; setae also somewhat longer on tergum

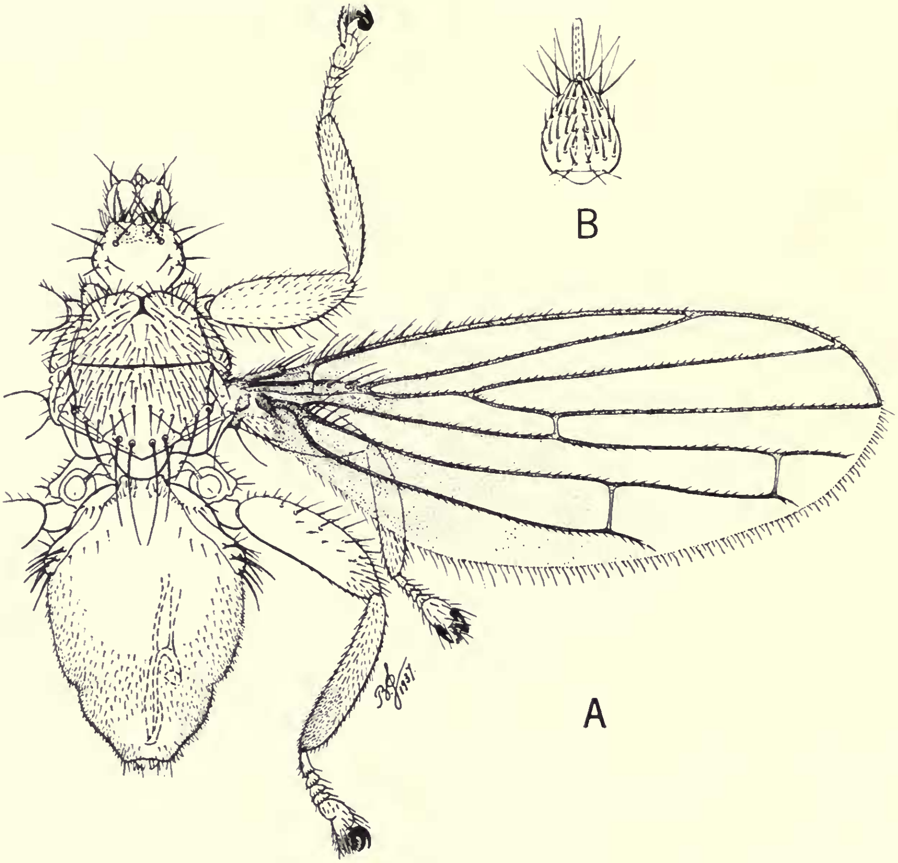

Fig. 56. *Trichobius yunkeri,* new species. A, male, dorsal view. B, labium. From Jobling (1938, as *T. caecus*).

IX, and becoming more so apically, those along apical margin being macrosetae; gonapophyses as in fig. 57C.

Measurements:	BL	TL	WL	WW
Male	1.48–1.51	0.54–0.55	1.36–1.43	0.55–0.70
Female	1.24–1.84	0.52–0.66	1.43–1.60	0.55–0.71

MATERIAL EXAMINED: Lectoholotype female and two lectoparatype females from Guacharo Cave, TRINIDAD, from the collection of British Museum (Natural History). From Tamana Caves, TRINIDAD, 1 male reared from pupa, together with case, 20 November 1957, T. H. G. Aitken, collector [TVL]; 2 males, 3 females, same locality, from "*Chilonycteris rubiginosa*" (*Pteronotus parnellii*), 11 November 1954, C. Colin Sanborn [CNHM]; 11 males (4 too badly damaged to preserve, except genital mounts on slides) and 6 females, from same host, Guanapo Heights cave, TRINIDAD, 9 September 1954, C. C. Sanborn [CNHM].

Trichobius yunkeri Wenzel, new species. Figures 56, 57D–F.

Trichobius caecus (not Edwards, 1918), Jobling, 1938, Parasitology, **30**: 358, 364, 371 (part.), fig. 4. Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., **3**: 418. Jobling, 1949, loc. cit., **39**: 316 (part.), fig. 1A.

Closely related to *T. caecus* Edwards, but separated from it by the characters given in the key, notably the shape of the female postgenital sclerite (fig. 57E), the presence of five or six (instead of three or four) macrosetae on the female seventh sternites, and the shape of the male gonapophyses (fig. 57F).

DESCRIPTION: With the characters of *T. caecus* except as follows: *Male:* Gonapophyses (fig. 57F) longer, more slender, and more angulately bent at apex than in *T. caecus* (fig. 57C). *Female:* Median pair (sometimes three) of setae on tergum VII usually well developed (minute or absent in *caecus*), usually about half as long as the macrosetae lateral to them, sometimes with an additional seta lateral to one of the macrosetae; supra-anal plate with three apical and two or three short, stout lateral setae on each side. Seventh sternites covered with short setae which become longer near mesal edge; apical margin typically with five or six macrosetae, rarely four. Postgenital sclerite (fig. 57E) wider than in *caecus* (fig. 57B).

Measurements:	BL	TL	WL	WW
Male	1.51–1.59	0.52–0.59	1.37–1.43	0.55–0.66
Female	1.54–1.96	0.56–0.69	1.54–1.59	0.65–0.77

TYPE MATERIAL: Holotype male (slide) from *Pteronotus parnellii fuscus* (host no. 4437) from a railroad culvert at Paraíso (Canal Zone), 15 September 1959, C. M. Keenan and V. J. Tipton, collectors. Allotype female (slide), same data as the type but from host no. 4386, 16 September 1959. In the collection of Chicago Natural History Museum.

Paratypes.—370 specimens from *Pteronotus p. fuscus* as follows: 46 flies (18 bats), same data as the allotype and 42 (14 bats), same data as the holotype; 135 (40 bats), same data as holotype, but 1 December 1959; 19 (4 bats), railroad culvert east of Summit Golf Club, 26 October 1959; 15 (7 bats), mine shaft, Coco Plantation, Gamboa (Canal Zone), 25 November 1959; 2 (1 bat), Galeta Island (Canal Zone), 19 November 1959; 22 (1 bat), Madden Airstrip (Panamá), 3 October 1961; and 22 (1 bat), same data but 23 May 1961; 6 (2 bats), Chilibrillo Caves (Panamá), 28 October 1959; 22 (4 bats), Almirante (Bocas del Toro), 28 January to 1 February

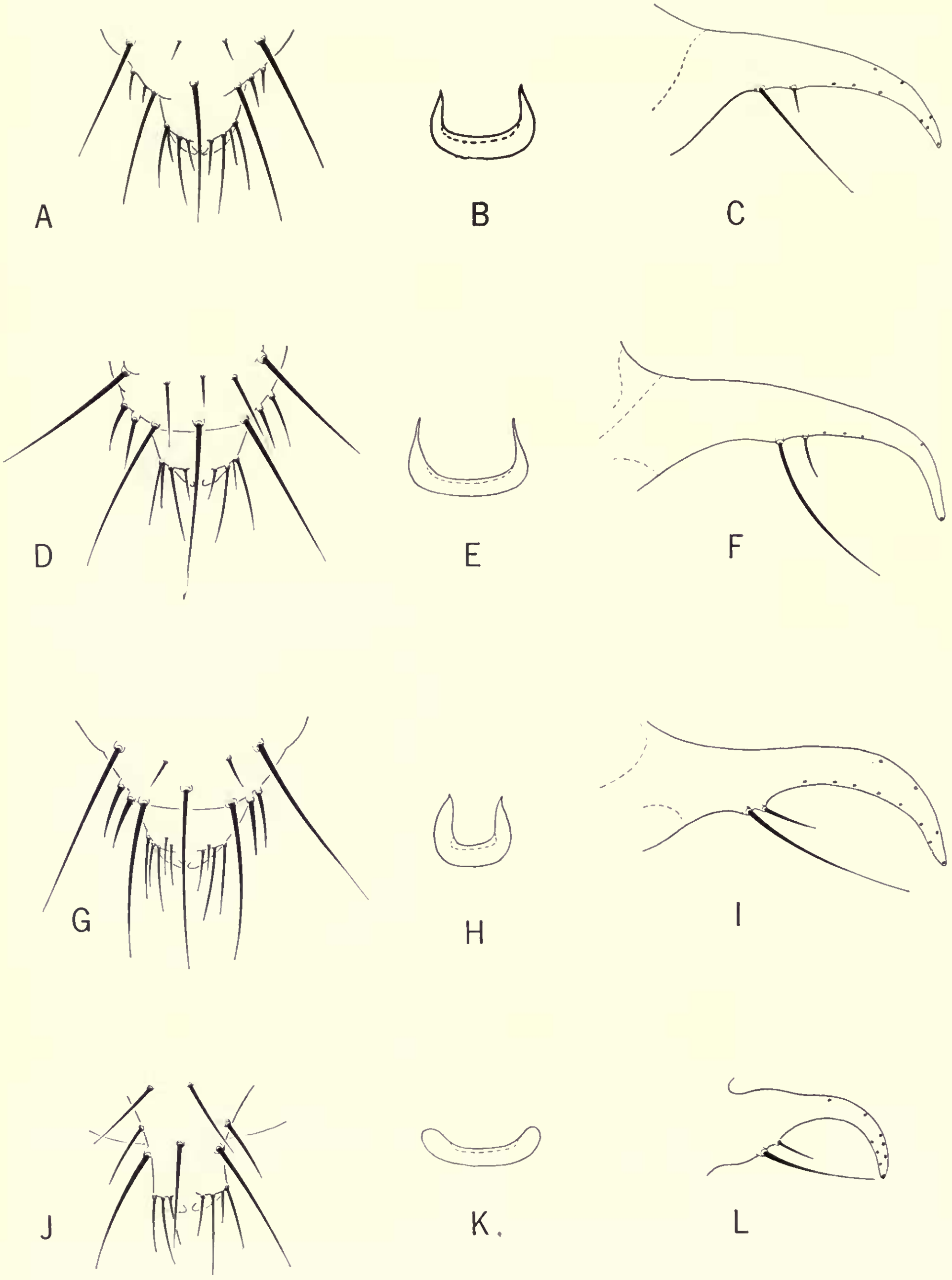

Fig. 57. Terminalia of *Trichobius caecus* group, including (from left to right) female terminal cone, female postgenital sclerite, and left male gonapophysis (lateral view). A–C, *Trichobius caecus* Edwards. D–F, *T. yunkeri* new species. G–I, *T. johnsonae,* new species. J–L, *T. galei,* new species.

1960; 13 (1 bat), Rio Chucunaque (Darién), 17 February 1958; 35 (6 bats), Guánico (Los Santos), 22 January, 13 February and 16 February 1962; 7 (2 bats), Cerro Hoya (Los Santos), 18 and 21 February 1962; 3 (3 bats), Buena Vista Caves (Colón), 3 September 1959; 7 (5 bats), same locality, 15 September 1959 and 16 (1 bat), 24 November 1959. Paratypes to be deposited in the collections listed on p. 410.

OTHER MATERIAL EXAMINED (50 specimens): From *Lonchorhina aurita:* 6 (2 bats), 17 July and 25 November 1959. From *Pteronotus suapurensis:* 1 (1 bat), Fort Clayton (Canal Zone), 19 October 1960; 27 (1 bat), Natural Bridge, Madden Dam (Canal Zone), 27 August 1959; 1 (13 bats), Chilibrillo Caves (Panamá), 28 October 1959. From *Sturnira ludovici* (mist net): 1 (1 bat), 11 March 1962. From *Carollia perspicillata azteca:* 3 (12 bats), railroad culvert east of Summit Golf Club (Canal Zone), 26 October 1959; 5 (22 bats), Buena Vista Caves (Colón), 3 September, 15 September and 24 November 1959. From *Artibeus lituratus palmarum:* 6 (1 bat), Cerro Azul (Panamá), 25 January 1958, GML.

We have also seen hundreds of specimens from *Pteronotus parnellii* from GUATEMALA, MEXICO, COLOMBIA and VENEZUELA, which are tentatively assigned to this species.

REMARKS: *Pteronotus p. fuscus* seems to be the primary host of this species. However, *T. yunkeri* was found together with *T. johnsonae* in equal abundance on *P. suapurensis* at Natural Bridge, Madden Dam, and there is no indication in our records that *P. p. fuscus* occurred there with that host, though this may have been so. In all other instances excepting two, where a bat other than *P. p. fuscus* was the host of *yunkeri, P. p. fuscus* was also known to be present. The small numbers of *yunkeri* taken on them could indicate that they were either strays or contaminations. *T. yunkeri* and related species tend to occur in swarms in the roosting sites of the host, thus greatly increasing the chances for such stray associations. We believe that the record from *Artibeus lituratus palmarum* represents an error in host identification or association. Virtually all the specimens received from this locality and collecting trip have incorrect host associations. In the case of the specimens from *Sturnira ludovici,* the host bat was collected in a mist net. When bats are thus captured, their streblids often leave and land on other nearby bats in the net. The species referred to by Cooper (1941, pp. 126, 127) as *caecus* is probably *T. yunkeri.*

Trichobius yunkeri n. sp. is named in honor of Dr. Conrad Yunker of the Rocky Mountain Laboratory (Hamilton, Montana) and the Middle American Research Unit, Canal Zone, Panamá.

Trichobius johnsonae Wenzel, new species. Figures 55A, 57G–I.

Very closely related to and generally with the characters of *T. caecus* Edwards and *T. yunkeri* n. sp., but differing from them in having only six to nine (rather than 11–16) setae on the lateral lobes of syntergum I+II, the very minute setae of the female seventh sternites, and especially in the shape of the female postgenital sternite and the relatively heavy male gonapophyses.

DESCRIPTION: Lateral lobes of syntergum I+II (fig. 55A) with only six to nine coarse setae and sometimes several finer setae ventral to these. *Wings.*—R_8 bare on about basal fourth, approximately twice as long as distance from fork to crossvein *r-m* (11.5:7). *Female:* Seventh sternites with extremely fine, short setae outwardly, these longer toward mesal margin. Postgenital sclerite narrow and heavy (fig. 57H). *Male:* Gonapophyses as in fig. 57 I.

Measurements:	BL	TL	WL	WW
Male	1.59–1.70	0.45–0.58	1.45–1.48	0.71–0.73
Female	1.63–1.86	0.52–0.65	1.59–1.65	0.77–0.80

TYPE MATERIAL: Holotype male and allotype female (slides) from *Pteronotus psilotis* (host no. 8772) Penonomé Cave (Coclé), 15 December 1961, C. M. Keenan and V. J. Tipton, collectors. In the collection of Chicago Natural History Museum.

Paratypes (278 specimens).—From *Pteronotus psilotis:* 66 (11 lots), same data as the holotype; 2, same data but 24 January 1962; 10 (1 lot), Armila (San Blas), 13 March 1963. From *Pteronotus suapurensis:* 26 (1 lot), Madden Dam (Canal Zone), 27 August 1959; 3 (1 bat), Casa Tilley, Cerro Punta (Chiriquí), 6 March 1962; 81 (7 lots), Penonomé Cave (Coclé), 15 December 1961; 62 (4 lots), Chilibrillo Caves (Panamá), 28 October 1959, and 20 (1 lot), same locality, 8 March 1960; 8 (2 lots), Armila (San Blas), 28 February 1963. From *wall of cave:* 461 (4 lots), Penonomé Cave (Coclé), 15 December 1961. The San Blas specimens were collected by C. O. Handley, Jr. and F. M. Greenwell. Paratypes to be deposited in the collections listed on p. 410.

OTHER MATERIAL EXAMINED: 1 specimen from *Carollia perspicillata azteca,* Penonomé Cave (Coclé), 15 December 1961; 1 from *Lonchophylla robusta,* Chilibrillo Caves (Panamá), 2 August 1960.

REMARKS: We have seen a series of nine specimens, without host, labeled "Dominica, H. S. B.," sent to us by Dr. H. Oldroyd of the British Museum (Natural History). These had been determined by Kessel (1925) as *T. caecus,* but appear to be *johnsonae* or a new species closely related to it. They have an even heavier postgenital sclerite than do our specimens of *johnsonae* from Panama. We also have three lots, consisting of three males and two females, taken from *Pteronotus davyi fulvus* in Guatemala, which appear to be closely related to *johnsonae* but possibly represent a distinct new species.

Trichobius johnsonae is apparently restricted to *Pteronotus suapurensis* and *P. psilotis* in Panama. In most instances, both hosts were collected at the same localities. *Nycterophilia fairchildi* n.sp. occurs on the same hosts. The single records of *johnsonae* from *Carollia p. azteca* and *Lonchophylla robusta* are obviously of strays or contaminations. In both instances, the collections were from sites where *Pteronotus* were present.

T. johnsonae is named in honor of Dr. Phyllis Johnson, formerly of the Gorgas Memorial Laboratory, Panamá, and now at the University of California at Irvine.

Trichobius major group

As defined below, this group contains seven described species namely, *T. major* Coquillet, *hirsutulus* Bequaert, *corynorhini* Cockerell, *truncatus*

Kessel, *pseudotruncatus* Jobling, *sparsus* Kessel, and *sphaeronotus* Jobling. The first three are closely related, the others are provisionally assigned to the group. *T. sparsus* Kessel is the only species which has been collected in Panama. The following characters will serve to define the group.

Head.—Laterovertices and occipital lobes either not differentiated or very weakly sclerotized and poorly defined. *Abdomen.*—*Female:* Cerci united with the ventral arc of the terminal cone. *Male:* Sternum V divided into two sternites or with a longitudinal median groove which appears to divide it. Sternum VI absent. Gonapophyses with the accessory setae inserted anterior to the macrosetae.

Trichobius sparsus Kessel. Figures 42, 58.

Trichobius sparsus Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 15 (keyed), 17 (descr.), pl. 1. (fig. 7), pl. 2 (fig. 10)—Chilibrillo River, Panama ex "*Chilonycteris rubiginosa fusca*" (U. S. National Museum). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth. Wash., no. 155, p. 655. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479, fig. (Streblidae II.—6); 1935, Amer. Mus. Novit., no. 765, p. 9 (keyed). Jobling, 1938, Parasitology, **30**: 373–375, fig. 6. Bequaert, 1940, Rev. Acad. Colomb. Cien. Exact., Fis. y Nat., **3**: 418.

Trichobius sparsus is easily separated from the other species that occur in Panama by the distinctive mesonotal chaetotaxy (fig. 58B). To the characters given by Jobling (loc. cit.) the following may be added.

Head.—Palpi with setae on basal two-thirds of ventral surface, with microsetae on upper surface. *Thorax.*—Microsetae present along lateral margins of prescutum, posterior half of scutum, and anterior third of scutellum. *Abdomen.*—Tergum I+II with a median basal group of setae which extends obliquely posteriorly and ventrally on each side to join a cluster of about 14–16 setae on face of lateral lobe, anterior to the posterior cluster of macrosetae. Connexivum with four sets of minute segmental setae, the three anterior sets consisting of two pairs each (a pair on each side of middle), the posterior set a single pair. *Female:* Supra-anal plate with two apical macrosetae, two macrosetae at middle, a pair of shorter setae on each side at mid-length, and a short seta each side of middle at base. Seventh sternites large, each with about 21 bristles, including one macroseta that is nearly twice as long as next longest setae; connexivum with a long seta on each side, but not on margin, anterior to the seventh sternites. *Male:* Sternum V divided into two large transversely oval plates. Sternum VI absent. Gonapophyses (fig. 58C) straight in dorsal view, blade-like and moderately curved ventrally in lateral view; ventral macroseta very long and extending beyond apex of gonapophysis, the accessory seta inserted anterior to the macroseta; a row of minute submarginal setae along ventral margin distal to accessory seta, two or three on lateral face, and one close to dorsal edge near apex.

Measurements:	BL	TL	WL	WW
Male	1.65–2.01	0.60–0.75	1.60–1.87	0.66–0.88
Female	1.95–2.25	0.71–0.77	1.90–2.09	0.82–0.88

PANAMANIAN MATERIAL EXAMINED: 29 flies (13 lots) from 51 bats. From *Pteronotus parnellii fuscus*, 20 flies (10 lots) from 49 bats: 3 (2 bats), Almirante (Bocas del Toro), 29 January and 1 February 1960; 1, railroad culvert, Paraíso (Canal Zone), 16 September 1959; 4 (40 bats), same site and locality, 1 December 1959; 1, railroad culvert E. of Summit (Canal Zone), 26 October 1959; 1, Barro Colorado Island (Canal Zone), 12 January 1957 [USNM]; 3 (2 bats), Guánico (Los Santos), 13 and 16 February 1962; 8 (3 bats), Cerro Hoya (Los Santos), 14, 18 and 21 February 1962. From *Carollia perspicillata azteca:* 1, Almirante (Bocas del Toro), 31 January 1960. From *Artibeus lituratus palmarum:* 7, Cerro Azul (Panamá), 25 January 1958, Eustorgio Méndez [GML].

OTHER MATERIAL EXAMINED: The only other specimens we have seen were collected from *Pteronotus parnellii fuscus* in GUATEMALA.

The type of *sparsus* was collected from "*Chilonycteris rubiginosa rubiginosa*" (= *P. parnellii fuscus* of this paper). We believe this to be the

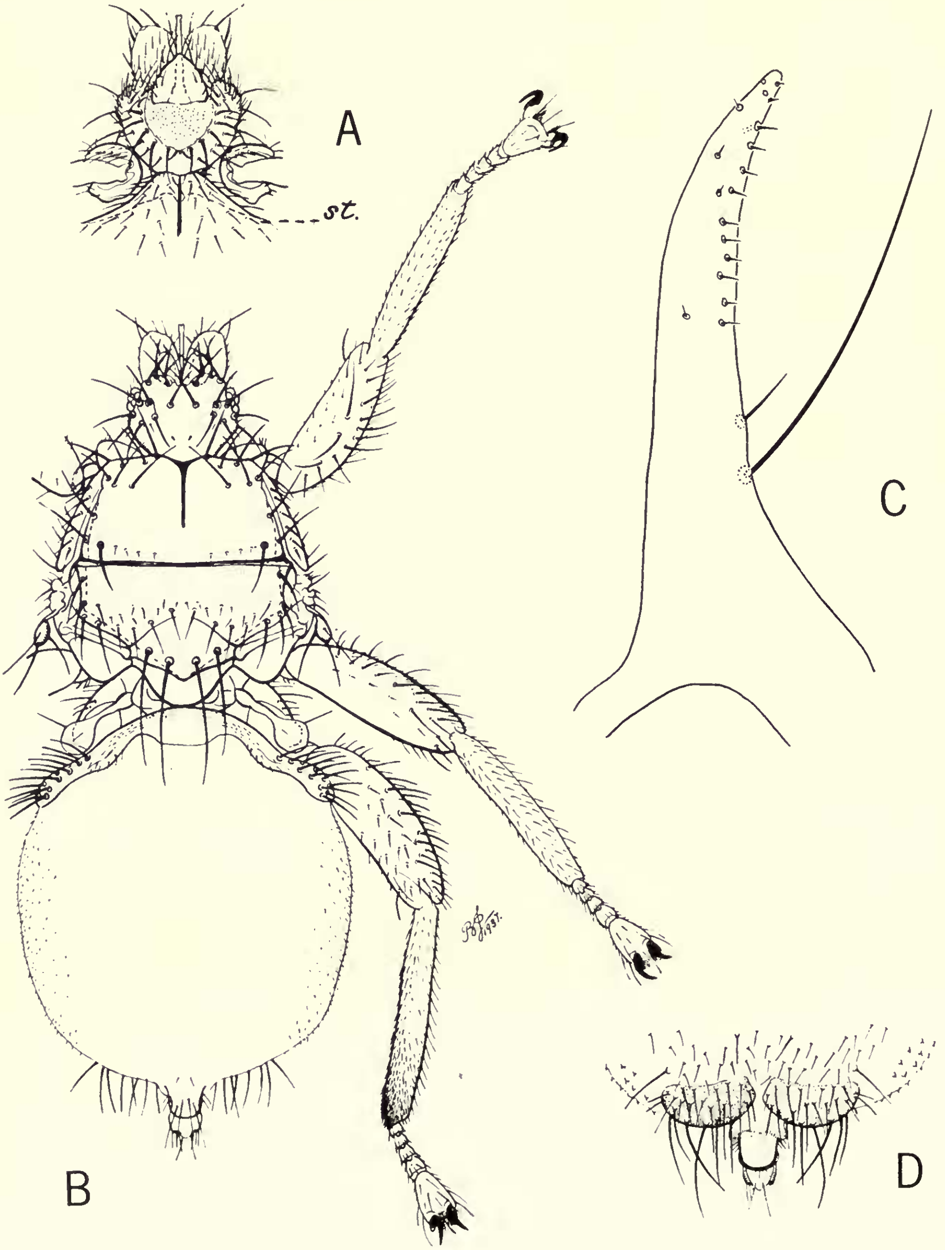

Fig. 58. *Trichobius sparsus* Kessel. A, underside of head and anterior part of thorax. B, dorsal view, female (wings removed). C, left male gonapophysis, lateral view. D, apex of abdomen, female, ventral view. A, B, D from Jobling (1938).

principal if not the only host of this species. The specimens listed for *Artibeus lituratus* from Cerro Azul were certainly labeled incorrectly. The vial in which they were contained included flies from at least seven different host species, including *Pteronotus p. fuscus.* Field records show that six of these host species were collected at that locality on the same date. None of the flies were parasites of *Artibeus.* The record from *Carollia* probably represents a stray.

Trichobius uniformis group

The species of this group have the following characters in common:

Small species, body 1.11–1.62 mm. long. *Head.*—With well-differentiated laterovertices and occipital plates, the laterovertices transverse, the occipital plates oblique; setae of laterovertices, genal and postgenal margins, and occipital plates borne on tubercles, the tubercles along margins of postgenae and occipital lobes very distinct. Eyes small, with about six facets. *Thorax.*—Setae of mesonotum relatively uniform in size and distribution, somewhat larger and sparser anteriorly; median mesonotal suture complete or nearly so, usually united with the transverse mesonotal suture which is usually complete though sometimes indistinct at middle. Sternopleura bluntly, not strongly produced anteriorly; posterior margin of pleurotrochantines slightly emarginate at middle, without a lobe. *Wings.*—All veins with macrosetae basally, those of R_1 extending a little more than halfway to apex of vein; setae of costa and R_1 borne on small tubercles, the setae becoming shorter apically toward junction; sixth longitudinal vein with setae nearly to base. *Legs.*—Short, the hind ones only slightly larger than fore- and midlegs. *Abdomen.*—*Female:* Tergum VII very feebly sclerotized, small, its setae minute. Cerci united with ventral arc of terminal cone. *Male:* Sternum V complete, undivided; VI present, very narrow. Gonapophyses with accessory seta inserted anterior to the macroseta.

Trichobius uniformis Curran. Figures 60B, 61B.

Trichobius uniformis Curran, 1935 (part.), Amer. Mus. Novit., no. 765, pp. 9 (keyed), 10 (descrip.), fig. 8. Paraíso (Canal Zone), Panamá, ex *Glossophaga s. leachii* (American Museum of Natural History).—Jobling, 1938 (part.), Parasitology, **30**: 364 (hosts), 365 (keyed); Bequaert, 1940 (part.), Rev. Acad. Colomb. Cienc. Exact., Fis. y. Nat., **3**: 418. Jobling, 1949 (part.), Parasitology, **39**: 316 ff. (hosts). Starrett and de la Torre, 1964, Zoologica, **49**: 57.

Curran's type series of *uniformis* included the holotype, allotype, and three paratypes from *Glossophaga s. leachii* and two paratypes from *Lonchophylla robusta.* The paratypes from *L. robusta* represent a distinct species, described below as *T. lonchophyllae* n. sp. *T. uniformis* may be distinguished by the characters given in the key. To the characters given by Curran (loc. cit.) and above, the following may be added:

Head.—Eyes distinctly removed from lateral margins of head. Innermost seta of posterior margin of occipital plate borne on a distinct, posteriorly projecting tubercle. *Thorax.*—Anterior margin of mesonotum straight, median suture usually indistinct posteriorly, often not united with the transverse suture. *Wings.*—R_1 parallel to costa for most of its length. Length of R_s approximately equal to distance between fork and crossvein *r-m.* *Abdomen.*—*Female:* Four minute setae of tergum VII arranged with the inner two smaller setae (occasionally absent) only slightly posterior to the outer pair, appearing as a transverse row. *Male:* Gonapophyses as in fig. 60B.

Measurements:	BL	TL	WL	WW
Male	1.18–1.24	0.43–0.47	0.95–1.18	0.44–0.51
Female	1.24–1.46	0.47–0.50	1.00–1.22	0.46–0.52

PANAMANIAN MATERIAL EXAMINED: 31 specimens (19 lots) from (19) *Glossophaga soricina leachii:* 2, Fort Davis (Canal Zone), 18 November 1959; 4, Fort Clayton (Canal Zone), 14 September and 13 October 1959; 2, Galeta Island (Canal Zone), 19 November 1959; 1, Fort Kobbe Beach (Canal Zone), 16 November 1959; 4 (holotype, allotype and 2 female paratypes), Paraíso (Canal Zone), 17 October 1930, L. H. Dunn [AMNH]; 3, San Lorenzo Cave, Fort Sherman (Canal Zone), 29 March 1960, and 2, cativo trees, Fort Sherman, 4 December 1959; 4, Río Hato (Coclé), 22 October 1959; 8, Santa Clara (Coclé), 27 October 1959; 1, Cerro Hoya (Los Santos), 17 February 1962. From *Artibeus j. jamaicensis:* 1, Fort Clayton (Canal Zone), 19 October 1960. From *Desmodus r. murinus:* 1, Almirante (Bocas del Toro), 24 January 1960. The specimens from *A. jamaicensis* and *D. rotundus* were taken from bats collected in mist nets.

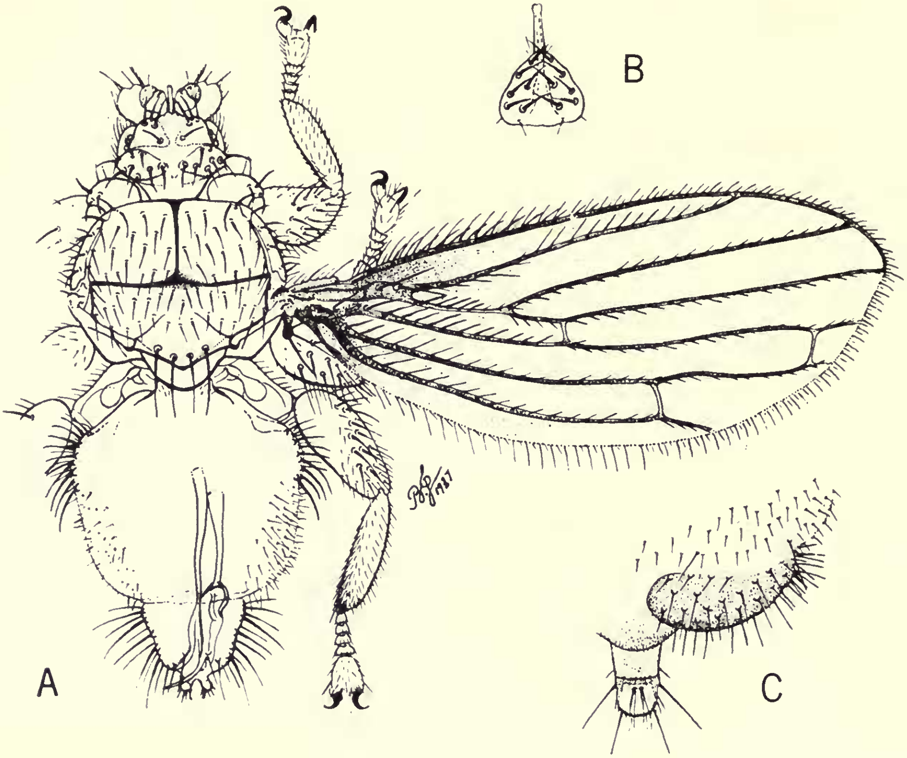

Fig. 59. *Trichobius lonchophyllae,* new species. A, dorsal view, male. B, labium. C, apex of abdomen, female, ventral view. From Jobling (1938, as *T. uniformis*).

OTHER MATERIAL EXAMINED: Numerous specimens from GUATEMALA, COSTA RICA, BRITISH GUIANA, and PERU, all from *Glossophaga soricina* except the British Guiana specimens which are without host.

REMARKS: Curran's figure (loc. cit.) of this species is inaccurate in many respects, including the length of R_S. However, the shape of R_1 is clearly that of *uniformis* and agrees with the holotype. This species appears to be limited to *Glossophaga soricina,* though it is possible that it may occur on other species of the genus *Glossophaga.* Published records from other hosts probably represent contaminations, errors of host identification, or other related species of the *uniformis* group.

Trichobius lonchophyllae Wenzel, new species. Figures 59, 60D, 61A.

Trichobius uniformis (part., ex *Lonchophylla robusta*) Curran 1935, Amer. Mus. Novit., no. 765, pp. 9, 10. Jobling, 1938, Parasitology, **30**: 380 (descr., fig.). Bequaert, 1940, Rev. Acad. Colomb. Cien. Ex., Fis. y Nat., **3**: 418. Jobling, 1949 (part.), Parasitology, **39**: 316 (hosts).

Although Jobling's (1938) records of *T. uniformis* refer in part to Curran's species, his description and figures are obviously based on specimens of *lonchophyllae* n. sp. Mr. Jobling informs us that "*T. uniformis* has been redescribed and illustrated from the two paratypes, a male and a female lent to me from the collection of the American Museum of Natural History." Through the courtesy of Dr. Paul Arnaud, the senior author has been able to re-examine the female paratype and determine it to be *lonchophyllae.* It differs from *uniformis* and related species by the characters given in the key. The following characters may be added to Jobling's description:

Head.—Relatively broad, the eyes conspicuously separated from sides. Innermost small seta of posterior margin of occipital plate borne on a distinct, posteriorly directed tubercle. *Thorax.*—Anterior margin of prescutum usually slightly projecting at middle; median suture connected with the transverse mesonotal suture, the latter straight or feebly anteriorly arcuate and not sharply defined on about middle third of width. *Wings.*—R_1 distinctly sinuate, the costal cell rather abruptly narrowed, but R_1 subparallel to costa from sinuation to juncture with costa; R_s distinctly longer (5.5:3.5) than distance between fork and crossvein *r-m.* *Abdomen.*—*Female:* Four minute setae of seventh tergum arranged in two transverse rows. Seventh sternite very broad, more than twice as long as broad. *Male:* Gonapophyses as in fig. 60D.

Measurements:	BL	TL	WL	WW
Male	1.18–1.21	0.44–0.49	1.09–1.15	0.52–0.57
Female	1.43–1.62	0.49–0.52	1.22–1.23	0.56–0.57

TYPE MATERIAL: Holotype male and allotype female (on slides) from *Lonchophylla r. robusta* (host no. 5081), Buena Vista Caves (Colón), 24 November 1959, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—From *Lonchophylla r. robusta:* 5, same data as the type, and 1, same data but 3 September 1949; 5, Chilibrillo Caves, Chilibre (Panamá), 27 March 1958; 2, same locality but 20 October 1961, C. M. Keenan and R. L. Wenzel; 1 (paratype of *T. uniformis* Curran), same locality, 9 March 1933 (no. 16), L. H. Dunn [AMNH]; 2, La Laguna (Darién), 2900 feet elevation, 2 June 1963, C. O. Handley, Jr.; 1, Armila (San Blas), 14 March 1963, C. O. Handley, Jr.; 16, Isla Bastimentos (Bocas del Toro), 30 January to 5 February 1963, C. O. Handley, Jr.; 3 (2 bats), 23 and 31 January, C. O. Handley, Jr. Paratypes to be deposited in Chicago Natural History Museum, the United States National Museum, and the Environmental Health Branch, USAFSC, at Corozal (Canal Zone).

OTHER MATERIAL EXAMINED: 2 males from *Artibeus lituratus palmarum,* Cerro Azul (Panamá) 2000 feet elevation, 25 January 1958, GML.

REMARKS: The characteristic shape of wing vein R_1 and the broad seventh sternites of the female are clearly shown in the illustration (fig. 59) of *uniformis* Jobling, 1938 (not Curran).

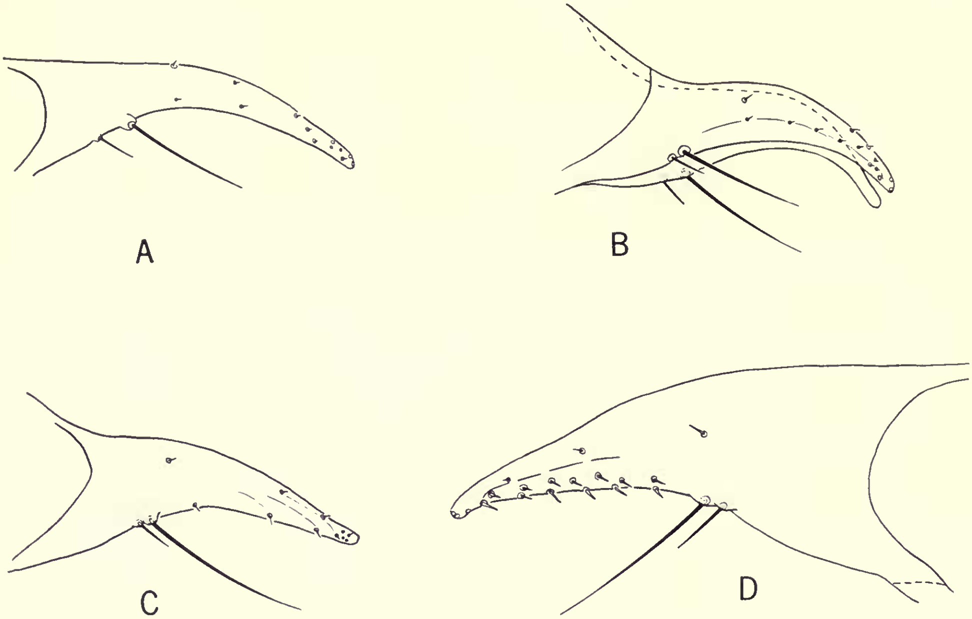

Fig. 60. *Trichobius uniformis* group. A–C, left male gonapophysis. A, *T. keenani,* new species, paratype from *Micronycteris megalotis* (no. 9208), Guánico (Los Santos). B, *T. uniformis* Curran, from *Glossophaga soricina leachii* (no. 4908), Santa Clara (Chiriquí). C, *T. lionycteridis,* new species, holotype. D, right gonapophysis, *T. lonchophyllae,* new species, holotype.

Thirteen of the 14 lots, including 36 of the 38 specimens, are from *Lonchophylla r. robusta.* However, we believe it may occur on other species of the genus *Lonchophylla,* too. The record from *Artibeus* is probably in error.

Trichobius keenani Wenzel, new species. Figure 60A.

Distinguished from related species by the characters given in the key.

DESCRIPTION: With the characters of the group and also the following. *Head.*—Not as broad as in other species of the group, the eyes projecting to or nearly to lateral margins of head; innermost small seta on posterior margin of occipital plates not borne on a conspicuous, posteriorly directed tubercle. *Thorax.*—Anterior margin of prescutum straight, median suture usually united with the transverse suture, sometimes slightly abbreviated. *Wings.*—R_s approximately as long as distance between fork and crossvein *r-m. Abdomen.—Female:* Four minute setae of seventh tergum arranged in a transverse row, the outer pair usually slightly anterior to the inner pair. Seventh sternites reniform, scarcely twice as broad as long. *Male:* Gonapophyses as in fig. 60A.

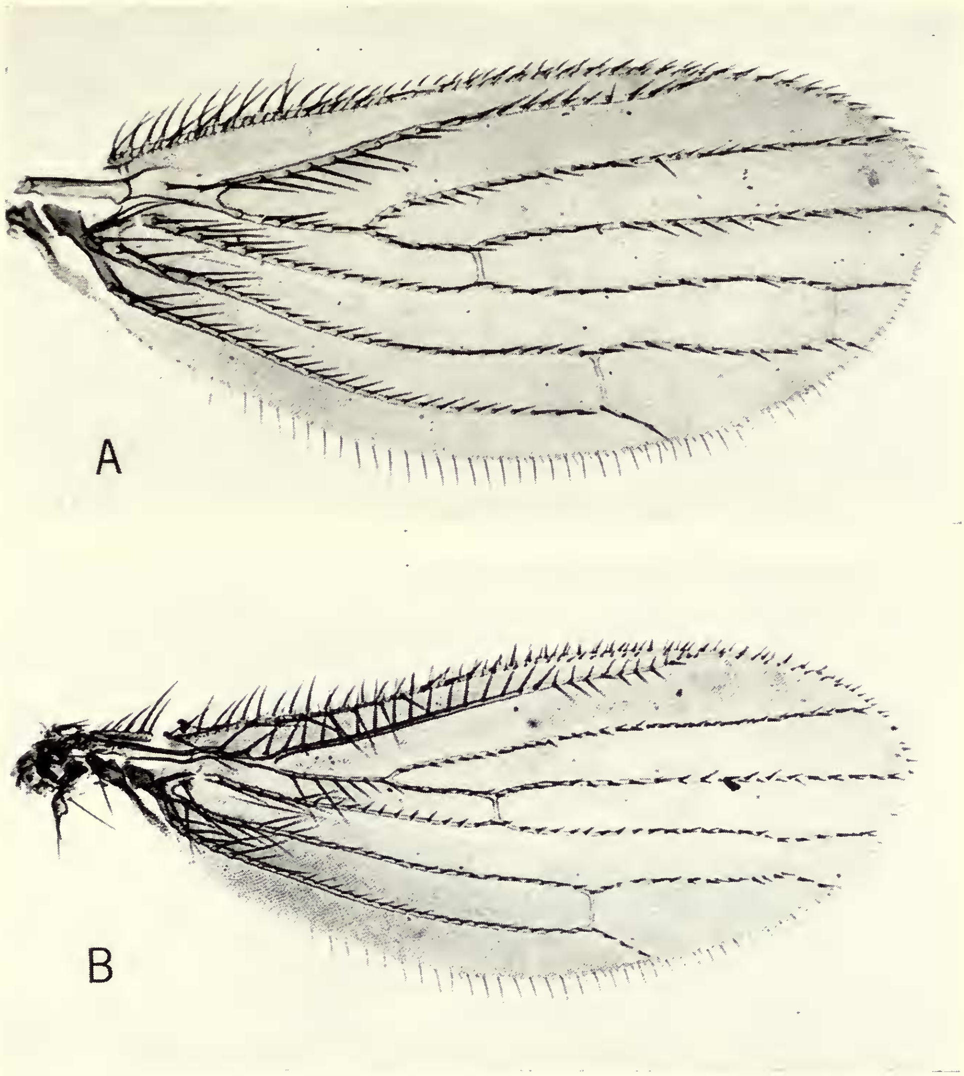

Fig. 61. Wing. A, *Trichobius lonchophyllae,* new species. B, *T. uniformis* Curran.

Measurements:	BL	TL	WL	WW
Male	1.12–1.18	0.38–0.42	0.99–1.02	0.48–0.50
Female	1.11–1.35	0.41–0.46	1.10–1.19	0.48–0.51

TYPE MATERIAL: Holotype male and allotype female (on slides) from *Micronycteris nicefori* (host no. 5544), Almirante (Bocas del Toro), 12 February 1960, V. J. Tipton and C. M. Keenan. In the collection of Chicago Natural History Museum.

Paratypes.—From *Micronycteris megalotis microtis:* 2, Camp Piña (Canal Zone), 1 April 1960; 3, culvert under Borinquen Highway near Empire Range (Canal Zone), 24 October 1961, C. M. Keenan and R. L. Wenzel; 3, same host, Guánico (Los Santos), 27 January 1962, C. M. Keenan and

V. J. Tipton. Paratypes deposited in the collections of Chicago Natural History Museum and the United States National Museum.

OTHER MATERIAL EXAMINED: From (2) *M. megalotis microtis:* 5 (destroyed accidentally), 24 October 1961, C. M. Keenan and R. L. Wenzel. From *Uroderma bilobatum:* 1, Fort Clayton (Canal Zone), 28 November 1960.

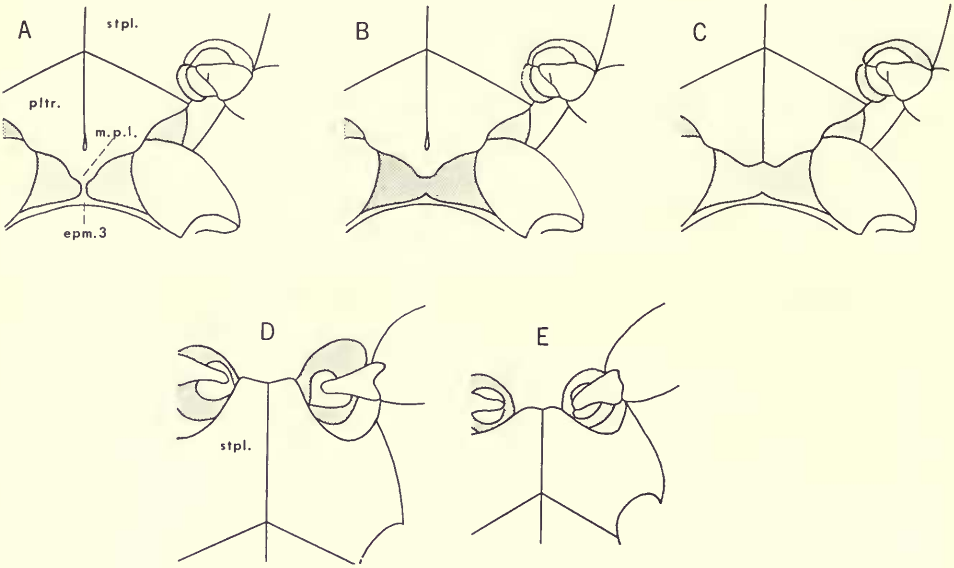

Fig. 62. A–C, posterior portion of venter of thorax showing condition in respect to median pleurotrochantinal lobe (*m.p.l.*): A, lobe united with metepimeron (*epm. 3*) as in *Trichobius longipes* (Rudow); B, lobe short and blunt, not united with metepimeron, as in *T. joblingi*, new species; C, lobe absent, as in *T. dugesioides*, new species. D, sternopleura, *Trichobius brennani*, new species. E, same, *T. longipes*.

Trichobius lionycteridis Wenzel, new species. Figure 60C.

Differing from related species by the characters given in the key.

DESCRIPTION: With the characters given for the group and also the following. *Head.*—Eyes only slightly separated from lateral margins of head. Innermost small seta on posterior margin of occipital plate not borne on a distinct, posteriorly directed tubercle. *Thorax.*—Anterior margin of prescutum slightly projecting at middle, median suture connected with the transverse mesonotal suture. *Wings.*—Length of R_s equal to or slightly shorter than distance from fork to *r-m*. *Abdomen.*—*Female:* Minute setae of seventh tergum arranged in two transverse rows; seventh sternite about twice as broad as long. *Male:* Gonapophyses as in fig. 60C.

Measurements:	BL	TL	WL	WW
Male	1.27	0.44	1.17	0.54
Female	1.40	0.49	1.29	0.62

TYPE MATERIAL: Holotype male from *Lionycteris spurrelli,* Armila (San Blas), 19 March 1963, C. O. Handley, Jr., collector. In the collection of the Chicago Natural History Museum. Paratype, a female from the same host.

east slope of the Andes, Quincemil, 13°15′S–70°35′W (Cuzco?), PERU, 2400 feet, 25 April 1947, John C. Pallister, collector. In the collection of the American Museum of Natural History.

Trichobius longipes group

Six species—*T. bequaerti* n. sp., *dybasi* n. sp., *mendezi* n. sp., *longipes* (Rudow) (=*mixtus* Curran), *costalimai* Guimarães, and *dunni* n. sp.—are included in this group. All except *T. dunni* n. sp. occur on species of *Phyllostomus* and *Tonatia,* related genera of the subfamily Phyllostominae (family Phyllostomidae). *T. dunni* was taken on *Molossus bondae* (family Molossidae). Several undescribed species that are related to *dunni* are known to us from other bats of the genus *Molossus.* The *longipes* group may be characterized as follows:

Head.—Laterovertices and occipital plates of head well differentiated. Median suture of mesonotum not forked. Eyes with 10–12 facets. *Thorax.*—Prescutal setae at middle of disk posterior to the median suture, denser and shorter than the lateral setae; antescutellar setae usually only slightly, if at all longer, than setae anterior to them. Pleurotrochantinal lobe dorsally reflexed and united with the metepimeron by a bar. *Wings.*—Sixth longitudinal vein lacking setae basally. *Abdomen.*—*Male:* Sternum V broad, undivided. Sternum VI very short, cord-like; gonapophyses curved to the left (in dorsal view), the accessory setae inserted posterior to the macrosetae. *Female:* Tergum VII very small, transverse, and feebly differentiated, if sclerotized at all; typically with four small setae arranged in one or two rows; postgenital sclerite not visible. Cerci free, not united with the ventral arc.

Trichobius longipes (Rudow). Figures 62A, E; 63F; 64.

Strebla longipes Rudow, 1871, Zeitschr. Ges. Naturw., (n.s.), **37**: 121; 1872, Ann. Mag. Nat. Hist. (4), **9**: 407—Without locality, from "*Phyllostoma hastatum*" (Zoologische Staatsinstitut und Zoologische Museum, Hamburg). Speiser, 1902, Zeitschr. Hymen. Dipt., Heft 3, p. 159 (synonymized with *T. parasiticus* Gervais, in error).

Trichobius dugesii (not Townsend, 1891), Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 16, pl. 1, fig. 1. Jobling, 1938, Parasitology, **30**: 383, fig. 12. Bequaert, 1940, Rev. Acad. Colomb. Cien. Exact., Fis. y Nat., **3**: 418 (part.). Cooper, 1941, Yearb. Amer. Phil. Soc., **1941**: 124, 126 (part.).

Trichobius mixtus Curran, 1935, Amer. Mus. Novit., no. 765, pp. 9 (keyed), 10 (descr.), fig. 10—Chilibrillo Caves, Panama, from *Phyllostomus hastatus panamensis* (American Museum of Natural History). Guimarães (part.), 1938, Rev. Mus. Paulista, **23**: 654 (descr.), 662 (keyed), figs. 1,2; 1941, Papeis Avulsos, **1**: 215. Bequaert, 1942, Bol. Ent. Venez., **1**: 87. Guimarães, 1944, loc. cit., **6**: 189–191, figs. 18, 19, pl. 1, figs. 2,3 (puparium). Jobling, 1949, Parasitology, **39**: 316 ff. (hosts), 326 (records), fig. 2A. Goodwin and Greenhall, 1961, Bull. Amer. Mus. Nat. Hist., **122**, art. 3, pp. 238, 240. Starrett and de la Torre, 1964, Zoologica, **49**: 56. *New synonym.*

The unique female type of *Strebla longipes* Rudow which was originally mounted dry on a slide was kindly lent to us by Dr. Herbert Weidner of the Zoological Museum at Hamburg with permission to remount it. The specimen had been flattened from the pressure of the slip. We first treated it with trisodium phosphate, then with KOH, and remounted it in canada balsam. Though it is still not an ideal study specimen, it is possible to establish its identity with *Trichobius mixtus* Curran, which was treated by

Jobling (1938) as *T. dugesii.* To the description given by Jobling, we add the following:

Head.—Eyes with ± 11 facets. *Thorax.*—Microsetae present along upper edges of anepisterna, margins of prescutum along the longitudinal membranous cleft, the metanotum and the laterotergite. Median pleurotrochantinal lobe reflexed dorsally and united by a bar to the metepimeron (fig. 62A). *Abdomen.*—Anterior face of tergum I+II with a single seta. Dorsal connexivum with two pairs of minute segmental setae. *Female:* Lateral connexivum with a cluster of six to eight setae coarser and longer than the other connexival setae, posterior to the lateral lobes of tergum I+II, and with a lateroventral subapical macroseta on each side, anterior to the seventh sternites. Tergum VII with a transverse row of four minute setae, the middle pair slightly posterior to the outer. Supra-anal plate with four apical macrosetae and a short seta at mid-length on each side. Sternum I+II setose in a broadly triangular area and on each posterior angle; setae of apical margin slightly longer than the discal setae, increasing in length toward

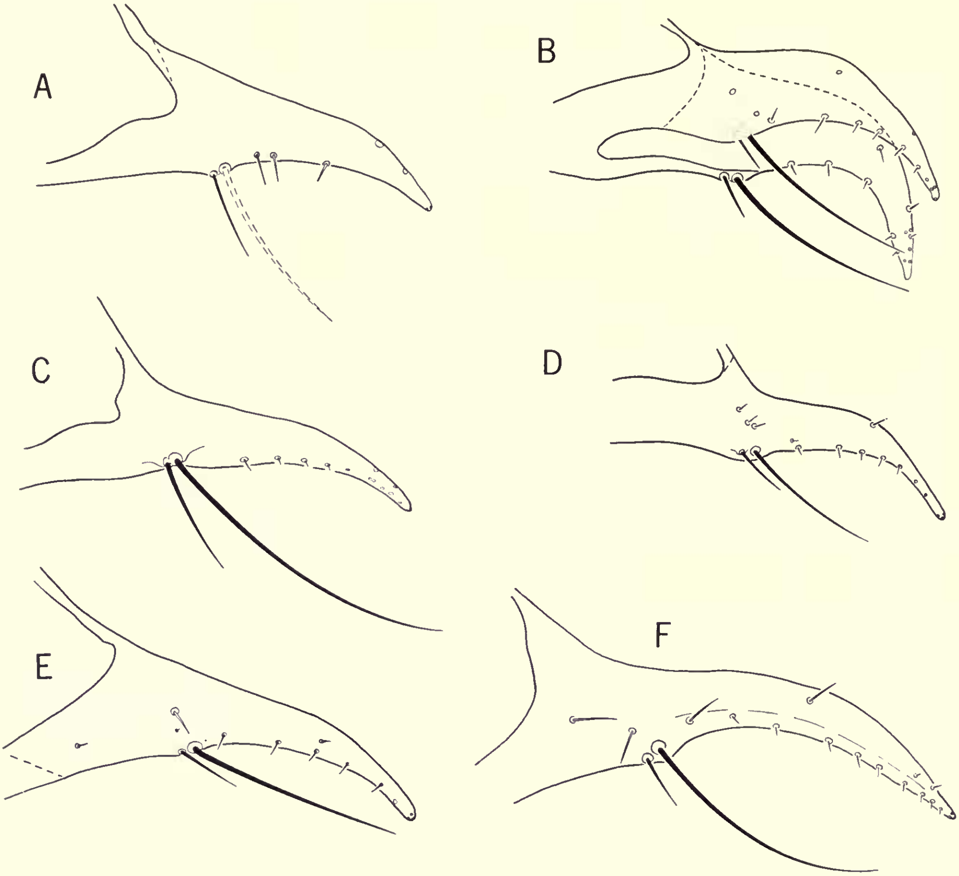

Fig. 63. Left male gonapophysis, *Trichobius longipes* group. A, *T. bequaerti,* new species, holotype. B, *T. dybasi,* new species, paratype from *Tonatia silvicola* (no. 11903), Armila (San Blas). C, *T. dunni,* new species, holotype. D, *T. mendezi,* new species, holotype. E, *T. costalimai* Guimarães. F, *T. longipes* (Rudow), from *Phyllostomus h. panamensis* (no. 4644), Chepo Road (Panamá).

the sides. Seventh sternites with about 11–12 setae, basal setae short, apical setae long, one a macroseta that is markedly longer than the others. *Male:* Gonapophyses slightly asymmetrical, both sinuate to left (in dorsal view), feebly curved apically in lateral view (fig. 63F).

Measurements:	BL	TL	WL	WW
Male	1.76–2.13	0.70–0.71	1.29–1.54	0.73–0.77
Female	1.87–2.35	0.78–0.82	1.59–1.92	0.73–0.85

PANAMANIAN MATERIAL EXAMINED: A total of 361 specimens (50 lots) from more than 90 bats. From *Phyllostomus hastatus panamensis,* 344 flies (48 lots) as follows: 35 (5 bats), Fort Kobbe (Canal Zone), 9 October 1959; 49 (19 bats), Fort Sherman (Canal Zone), 4 to 6 April 1960 and 30 July 1959; 3 (2 bats), Chágres River Cave, below Natural Bridge, Madden Dam (Canal Zone), 28 September 1959; 35 (6 bats), Natural Bridge, Madden Dam, 31 August 1959, and 9 (4 bats), same locality, 18 September 1959; 13, Farfan (Canal Zone), 19 December 1915, T Hallinan [AMNH]; 4, Culebra (Canal Zone), 29 October 1930, L. H. Dunn [AMNH]; 9 (1 bat), Camp Piña (Canal Zone), 29 January 1960; 1, Río Chilibrillo (Panamá), 27 August 1957; 26 (20 bats), Chilibrillo Caves, 17 July 1957, and 43 (10 bats), same locality, 28 October 1959; holotype, same locality, 4 August 1931, L. H. Dunn [AMNH]; 2, Pacora (Panamá), 24 April 1957 [USNM]; 9, Tapia (Panamá), J. R. Chapin [MCZ]. 1 (1 bat), Almirante (Bocas del Toro), 29 January 1960. From *Phyllostomus* sp.: 1, "Panama," 19 May 1957 [USNM]. From a mixed collection of *Phyllostomus* and *Pteronotus* spp.: 1, Río Chilibrillo (Panamá), 27 August 1957, R. M. Altman. From *Artibeus jamaicensis jamaicensis:* 11 (3 bats), Natural Bridge, Madden Dam (Canal Zone). From *Carollia perspicillata azteca:* 1, Miraflores (Canal Zone), Kenneth W. Cooper [MCZ]. *Without host:* 2, "Chiriqui," 21 December 1961, C. Yunker; 1, Chilibrillo Caves, 1 January 1916, T. Hallinan [AMNH]; 1, host K-16, Barro Colorado Island (Canal Zone), 2 December 1956 [USNM].

OTHER MATERIAL EXAMINED: We have seen about 70 specimens (25 lots) of this species from *Phyllostomus h. hastatus* and *P. h. panamensis,* from BOLIVIA, PERU, COLOMBIA, VENEZUELA, SURINAM, TRINIDAD, COSTA RICA, and GUATEMALA.

REMARKS: Although *Phyllostomus hastatus* appears to be its principal host, *T. longipes* has also been taken from *Phyllostomus discolor* in Trinidad (Jobling, 1949, p. 317). Guimarães (1938, p. 654) has recorded it from *P. hastatus* from Minas Gerãis and São Paulo, Brazil, but his record (loc. cit.) from "*Hemiderma perspicillatum*" may be of a different species, perhaps *Trichobius joblingi* n. sp. Hoffmann's record (1953: 186) of *T. mixtus* from Yucatan (from *Artibeus jamaicensis yucatanicus*) is probably of an undescribed species that is known to us from *Artibeus,* in Mexico, Guatemala, and the West Indies. In this undescribed species, which is very similar in appearance to *longipes,* the pleurotrochantinal lobe is not united with the metepimeron and the transverse mesonotal suture is strongly angulate.

One of the distinctive characters of *T. longipes* is the pronounced sexual dimorphism in mesonotal chaetotaxy (fig. 64). The three following species resemble *longipes* very closely in most characters, except as indicated in the key, but the mesonotal chaetotaxy is nearly identical in both sexes.

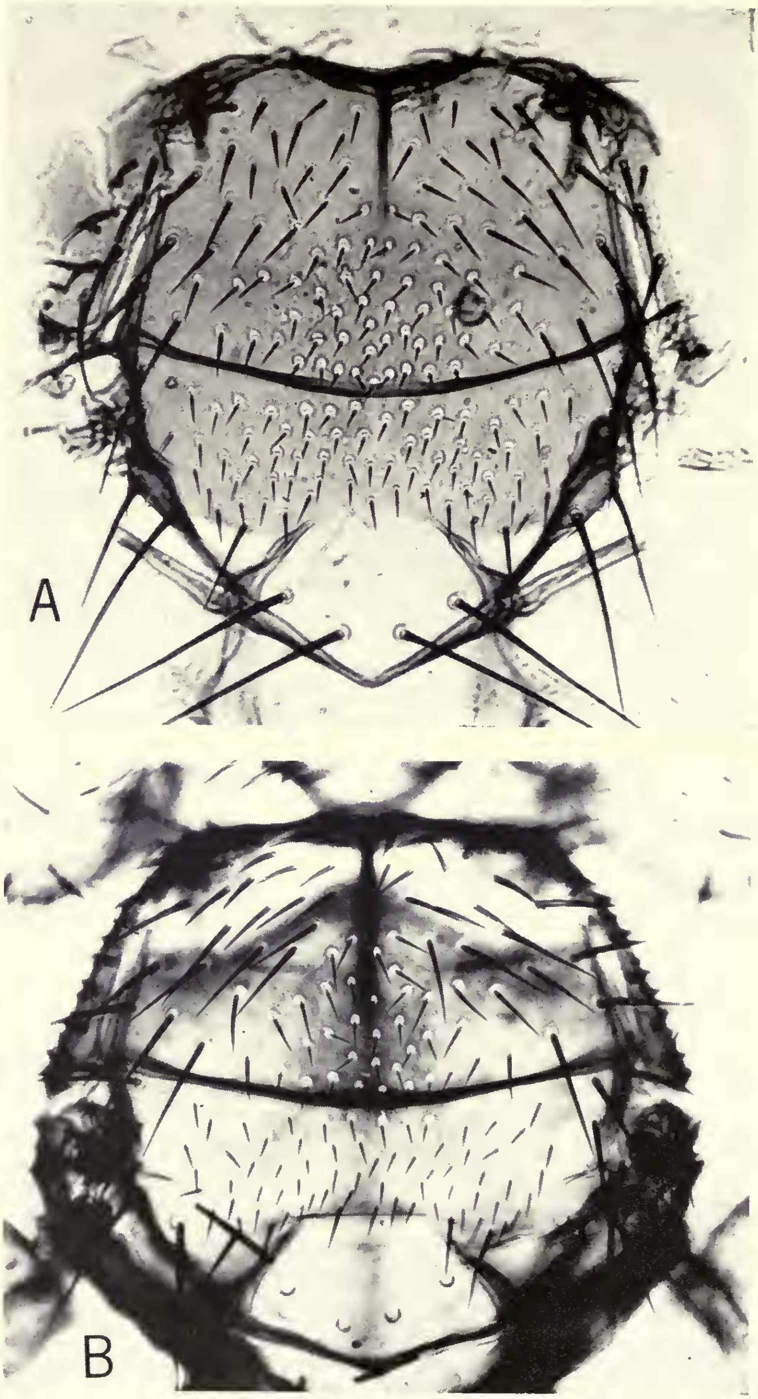

Fig. 64. *Trichobius longipes* (Rudow), thorax, dorsal view. A, male. B, female.

Trichobius mendezi Wenzel, new species. Figures 63D, 65B.

Very similar to *T. longipes* (Rudow) but smaller and in general with shorter setae, and differing in lacking a cluster of coarse connexival setae on each side behind the lateral lobes of tergum I+II in the female and in the distinctive male gonapophyses.

DESCRIPTION: *Head.*—Eyes with about 10 facets. *Thorax.*—Long prescutal setae, limited to sides, not extending inwardly to median suture anterior to the denser median discal setae; discal setae only slightly denser at middle, becoming gradually sparser laterally and anteriorly and not noticeably shorter than the setae on anterior half of prescutum on inner half of width. Median antescutellar scutal setae at middle about twice as long as the shortest scutal setae anterior to them. *Abdomen.*—Dorsal connexivum with three sets of minute segmental setae, the posterior set usually consisting of two pairs rather than one; connexivum posterior to lateral lobes of tergum I+II without cluster of coarser, longer setae. *Female:* Tergum VII with four very short setae, the anterior pair more widely separated and a little longer than the posterior pair. Supra-anal plate with four apical macrosetae and at mid-length on each side a shorter seta. Sternum I+II noticeably emarginate at middle, setae at apical margin only slightly longer than discal setae and not noticeably longer toward sides, extending around sides to about halfway to base. Seventh sternites with about 14 or 15 setae, the basal ones short, the apical ones long, two macrosetae conspicuously longer than the rest. Lateral connexivum, anterior to seventh sternites, with a conspicuous macroseta (as in *joblingi* etc.). *Male:* Sternum V with apical setae only a little longer than the discal setae, not conspicuously longer laterally. Gonapophyses (fig. 63D) very similar to those of *longipes* but smaller, more slender and curved apically.

Measurements:	BL	TL	WL	WW
Male	1.63–1.73	0.54–0.55	1.13–1.20	0.55–0.63
Female	1.59–1.71	0.55–0.62	1.15–1.32	0.60–0.69

TYPE MATERIAL: Holotype male from *Tonatia minuta* (host no. 11764), Armila (San Blas), 20 March 1963, C. O. Handley, Jr. and F. M. Greenwell, collectors; allotype female, same data (host no. 11916), but 26 March 1963. In the collection of Chicago Natural History Museum. Paratypes.—2 males (2 bats), same host as holotype, Sibube (Bocas del Toro), 17 January 1963, C. O. Handley, Jr.; 1 male, same host, Puerto Obaldía (San Blas), 3 April 1963, C. O. Handley, Jr. and F. M. Greenwell; 2 females, same host, Cerro Hoya (Los Santos), 26 February 1962, V. J. Tipton and C. M. Keenan. Paratypes to be deposited in the collections of the Chicago Natural History Museum and the United States National Museum, Washington, D. C.

REMARKS: These and other data indicate that *mendezi* is restricted to *Tonatia minuta.* This species is named after Mr. Eustorgio Méndez of the Gorgas Memorial Laboratory in recognition of his contributions to our knowledge of the ectoparasites of Panama.

Trichobius dybasi Wenzel, new species. Figures 63B, 65A.

Very closely related to *T. longipes* (Rudow) and *T. mendezi* n. sp., and differing from both in that the median discal mesonotal setae are not abruptly denser than the lateral and anterior setae. As in *mendezi,* the female lacks a cluster of conspicuously longer or coarser connexival setae on each side posterior to the lateral lobes of tergum I+II.

DESCRIPTION: With the characters of *T. longipes* except as follows. *Thorax.*—Prescutal setae becoming only slightly longer anteriorly along median suture, gradually longer laterally; median discal area not well defined. *Abdomen.*—*Female:* Connexivum

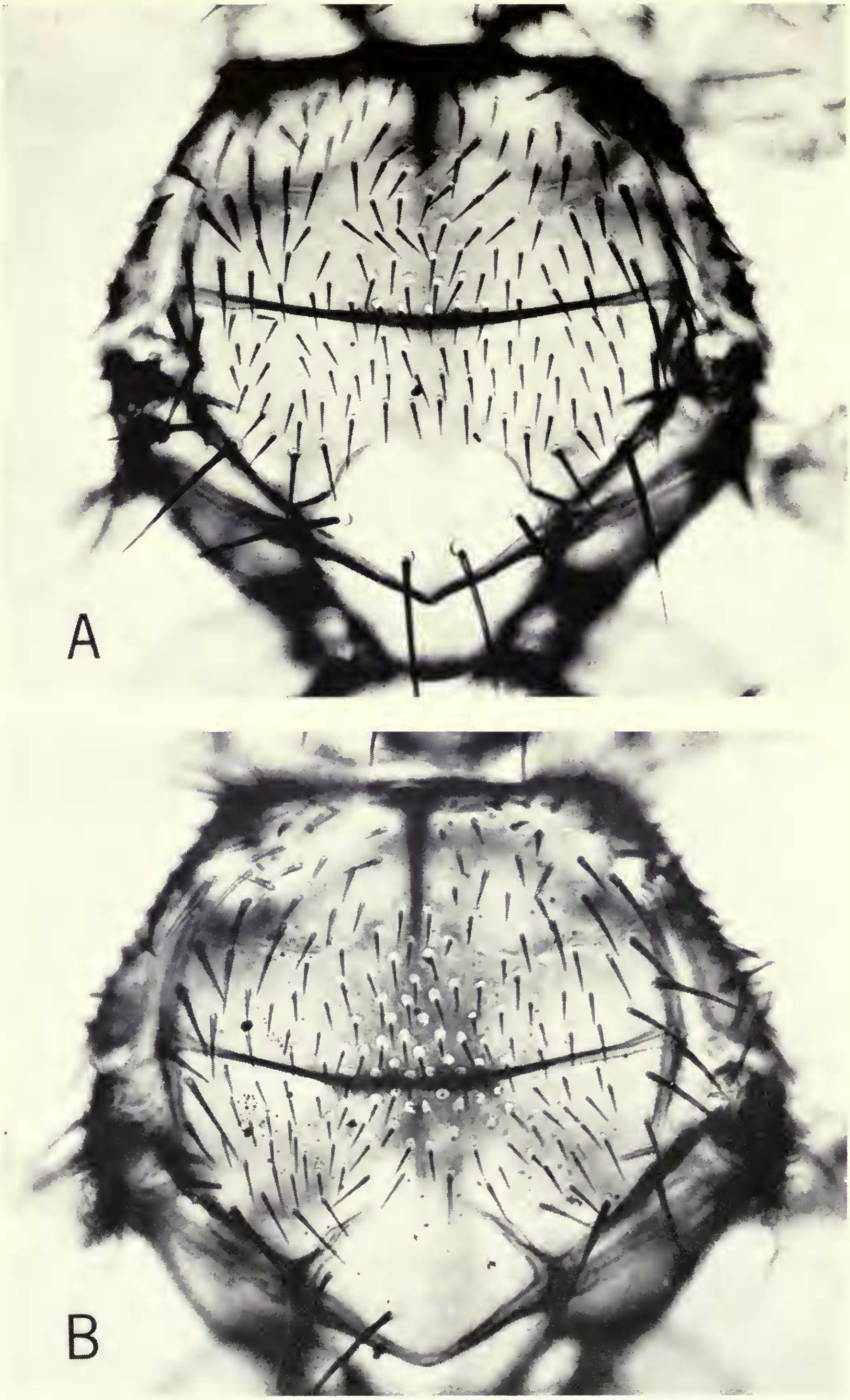

Fig. 65. Thorax, dorsal view. A, *Trichobius dybasi*, new species, allotype. B, *T. mendezi*, new species, female paratype from *Tonatia minuta* (no. 11916), Armila (San Blas).

without cluster of coarser setae on each side behind lateral lobes of tergum I+II. Seventh sternites with 11 setae. *Male:* Gonapophyses as in fig. 63B; sinuate to the left in lateral view and appearing very strongly, downwardly curved apically.

Measurements:	BL	TL	WL	WW
Male	1.46–1.63	0.54–0.58	1.15–1.26	0.60–0.66
Female	1.58–1.77	0.60–0.63	1.26–1.40	0.60–0.71

TYPE MATERIAL: Holotype male and allotype female from *Tonatia silvicola* (host no. 11903), Armila (San Blas), 25 March 1963, C. O. Handley, Jr. and Francis M. Greenwell, collectors. In the collection of Chicago Natural History Museum. Paratypes.—1 male, 3 females, same data as the holotype; 1 male, 3 females, same data, but 17 March 1963; 2 males, 1 female, same data, but 22 March 1963; 2 males, 1 female, same host and collectors, Puerto Obaldía (San Blas), 3 April 1963; 1 female, same host, Sibube (Bocas del Toro), 22 January 1963, C. O. Handley, Jr. Paratypes to be deposited in the collections of Chicago Natural History Museum; United States National Museum; the Gorgas Memorial Laboratory (Panamá); and the Environmental Health Branch, USAFSC, at Corozal (Canal Zone).

REMARKS: This species is named after Mr. Henry Dybas, Associate Curator of Insects, Chicago Natural History Museum, who earlier collaborated with the senior author in studying these flies.

Trichobius bequaerti Wenzel, new species. Figures 63A, 66A.

Very similar to *T. longipes* (Rudow), *dybasi* n.sp., and *mendezi* n.sp., but the patch of microsetae on each side of prescutum is not restricted to extreme lateral margin, the antero-median prescutal setae are as long as the laterals, and the male gonapophyses are heavier (fig. 63A).

DESCRIPTION (*Male*): With the characters of the group and the following. *Thorax.*—Discal mesonotal setae denser at middle, the mesonotal setae much longer apically and laterally. Microsetae of postero-lateral angles of prescutum extending inwardly from margin to second longitudinal row of setae (from margin), and anteriorly from transverse suture to second transverse row of setae (from suture). *Abdomen.*—With four pairs of minute dorsal segmental connexival setae. Gonapophyses (fig. 63A) not as strongly curved in lateral view and more wedge-shaped than in *T. longipes.*

Measurements:	BL	TL	WL	WW
Holotype male	1.65	0.58	1.40	0.71

TYPE MATERIAL: A unique holotype male (slide) from *Tonatia bidens* (host no. 5489) Almirante (Bocas del Toro), 28 January 1960, collected by V. J. Tipton and C. M. Keenan. In the collection of Chicago Natural History Museum.

REMARKS: This species is named after Dr. Joseph C. Bequaert, formerly Curator of Insects at the Museum of Comparative Zoology, Harvard University, in recognition of his outstanding contributions to our knowledge of the pupiparous Diptera.

Trichobius costalimai Guimarães. Figures 63E, 67B.

Trichobius costalimai Guimarães, 1937, Revista Mus. Paul., 23: 660 (descr.), 662 (keyed), pl. 3, fig. 10—from undetermined bat, Recife, Pernambuco (type depository not given). Jobling, 1938, Parasitology, **30**: 368, fig. 14B. Goodwin and Greenhall, 1961, Bull. Amer. Mus. Nat. Hist., 122, art. 3, p. 238.

T. costalimai is easily identified by the very distinctive mesonotal chaetotaxy (fig. 67B). It is the only species of the *longipes* group known to us in which the underside of the thorax and the hind coxae are microsetose. In addition to the characters listed in the original description, the following may be given:

Thorax.—Microsetose area of prescutum extending inwardly along transverse suture almost to fourth seta from lateral margin; elsewhere on basal half extending beyond the second row of setae, and on anterior half about two-thirds the distance to median suture; sternopleura and pleurotrochantines microsetose; sternopleural projection pointed. *Legs.*—Hind coxae microsetose below. Femora and tibiae, as well as procoxae and trochanters of middle legs with transverse lines; and with base of each seta on coxae and surrounded by a slightly elevated ring.

Abdomen.—Inner dorsal margin of lateral lobes of tergum I+II without a row or cluster of fine setae between apical coarse setae and base; one or two short setae on anterior face. Connexivum with two sets of dorsal segmental setae, the anterior set a single pair, the posterior set consisting of two pairs. Setae of sternum II subequal. *Female:* Connexivum without a cluster of coarser, longer setae on each side posterior to lateral lobes of tergum I+II. Tergum VII with two pairs of short subequal setae. Seventh sternites with about 11 setae. Supra-anal plate very short, with four apical macrosetae, as well as a short seta on each side and another at mid-length anterior to outer macroseta. *Male:* Sternum V with setae of apical margin only slightly longer than on disk. Gonapophyses as in fig. 63E.

Measurements:	BL	TL	WL	WW
Male	1.72–1.76	0.63–0.66	1.29–1.43	0.58–0.66
Female	1.76–1.77	0.68–0.71	1.51–1.54	0.71–0.74

PANAMANIAN MATERIAL EXAMINED: From *Phyllostomus d. discolor,* 19 (4 lots) as follows: 10, Río Tuira (Darién), 10 March 1958, P. Galindo [GML]; 2, Río Mandinga (San Blas), 29 May 1957, P. Galindo [GML]; 6, Armila (San Blas), 1 April 1963, C. O. Handley, Jr. and F. M. Greenwell; 1, Almirante (Bocas del Toro), 31 January 1960. From *Uroderma bilobatum:* 1, Puerto Obaldía (San Blas), 3 April 1963, C. O. Handley, Jr. and F. M. Greenwell. From *Desmodus rotundus:* 2, Guánico (Los Santos), 26 January 1962. From *Pteronotus p. fuscus:* 1, Guánico (Los Santos), 22 January 1962. From *Carollia p. azteca:* 1, Guánico (Los Santos), 27 January 1962. From *Artibeus l. palmarum:* 1, Puerto Obaldía, 4 April 1963, Handley and Greenwell; 2, Cerro Azul (Panamá), 25 January 1958, E. Méndez [GML].

OTHER MATERIAL EXAMINED: About 428 (24 lots) additional specimens, off *Phyllostomus discolor,* from GUATEMALA, EL SALVADOR, COLOMBIA, VENEZUELA, SURINAM, TRINIDAD, and PERU. Of these, 18 lots (402 flies) were from *Phyllostomus d. discolor* and *P. d. verrucosus.* One lot each was taken from *Phyllostomus elongatus* and *P. h. hastatus.* The remaining specimens were without host or dubious ones such as *"Didelphis"* (!) and *Sturnira.* Other streblids from the Surinam lot labeled as from *Sturnira* were *Strebla consocius* n. sp., a parasite characteristic of *P. h. hastatus.*

REMARKS: *Phyllostomus discolor* appears to be the principal host of *costalimai.* It is our opinion that the records from other hosts taken at Guánico and Cerro Azul, in Panama, are in error. As pointed out elsewhere, a substantial percentage of the specimens collected at these localities were obviously incorrectly associated. We suspect that most of these, as well as the specimens of *costalimai* from other hosts, were from bats collected with mist nets (see *Collecting hosts,* above).

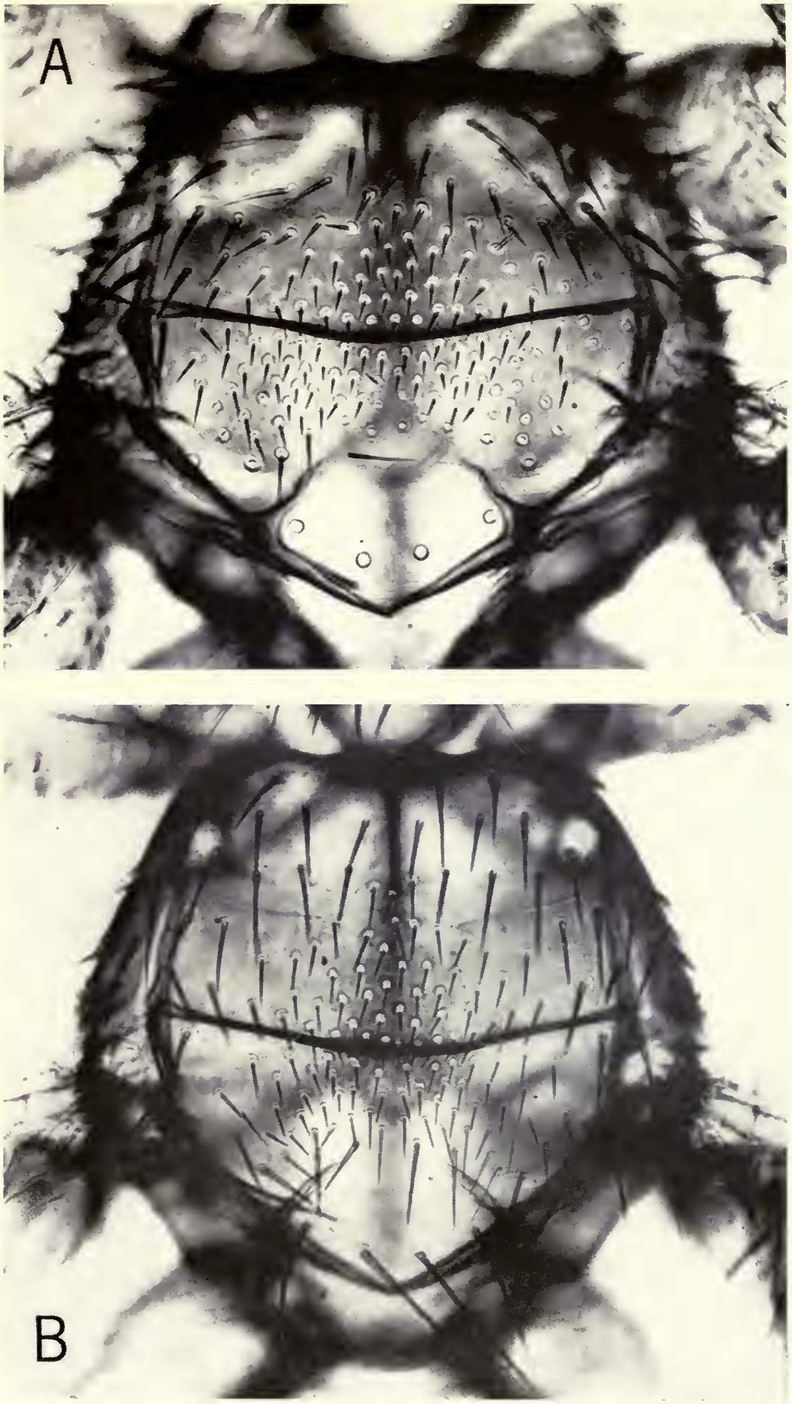

Fig. 66. Thorax, dorsal view. A, *Trichobius bequaerti*, new species, holotype. B, *T. urodermae*, new species, female paratype from *Uroderma bilobatum* (no. 6958), Rodman Naval Base (Canal Zone).

Trichobius dunni Wenzel, new species. Figures 63C, 67A.

Superficially resembling *T. phyllostomae* Kessel and *T. longipes* (Rudow), but differing from these and all other described species of *Trichobius* by the large number of bristles (17–19, as opposed to 10–12) on the occipital lobes of the head and by the distinctive male gonapophyses. The female is unknown.

DESCRIPTION (*Male*): *Head.*—Occipital plates each with about 15 conspicuous setae and on inner posterior margin about three additional short, fine setae. Palpi horizontal, their ventral surface densely clothed with short fine setae. Eyes conspicuous, with 11–12 large facets. *Thorax.*—Mesonotum distinctly convex, the anterior margin outwardly rounded, feebly emarginate at middle; median suture extending posteriorly to slightly beyond middle; setae longest and rather evenly distributed anteriorly and along sides, shorter posteriorly along sides; median discal setae shorter and denser posterior to the median suture and on scutum; setae of antescutellar row two to three times as long as setae immediately anterior to them; scutellum with four setae. *Wings.*—Costa with both long and shorter setae, the long setae becoming shorter and of uniform size about halfway to junction with R_1, the junction situated beyond level of third crossvein but not as far as midpoint between second and third crossveins; base of R_1 with two or three long setae, base of fifth longitudinal vein with two. *Legs.*—Relatively short, the femora progressively longer, the hind femora from one-fourth to one-third longer than profemora; femora clothed with both long and short setae. Tibiae subequal, their setae short, dense, rather uniform. Tarsi rather strongly compressed antero-posteriorly, the claws relatively small.

Abdomen: Lateral lobes of tergum I+II with numerous long setae, their inner dorsal margins each with one or two short setae. Connexivum dorso-laterally with moderately long setae anteriorly, becoming shorter apically and ventrally, the underside densely clothed with relatively short setae; three pairs of minute, dorsal, segmental setae present. Sternum V weakly sclerotized, the discal setae similar to those of ventral connexivum, but those along apical margin distinctly longer. Sternum VI very narrow, inconspicuous. Hypopygium clothed with long setae, these longest dorsally and apically, the apical ones being macrosetae. Gonapophyses as in fig. 63C.

Measurements:	BL	TL	WL	WW
Holotype male	1.84	0.72	1.54	0.69

TYPE MATERIAL: Holotype male from *Molossus bondae*, Río Chucunaque (Darién), L. H. Dunn (no. 841). In the collection of the Museum of Comparative Zoology at Harvard University.

REMARKS: *T. dunni* belongs to a small complex of closely related, undescribed species that are found on species of *Molossus.* The record of *Trichobius phyllostomae* (Curran, 1934, p. 523; Jobling, 1938, p. 377) from *Molossus obscurus* was probably based on one of these undescribed species. They appear to be the only New World Streblidae that occur on Molossidae. We have seen other undescribed species of this group from Mexico (*Molossus nigricans*), Guatemala (*Molossus* sp.), Venezuela (no host), Trinidad (*Molossus rufus*), and Brazil (no host).

Although the female of *dunni* is not known, it will very likely resemble those of the related undescribed species. In these, the seventh sternites are relatively much larger than in *longipes* and have numerous dense macrosetae. Although *dunni* has more numerous occipital setae than is usual in the genus, these setae are not as long and conspicuous as in the related, undescribed species.

Trichobius dunni is named after Major Lawrence H. Dunn, in recognition of his important contributions to medical entomology.

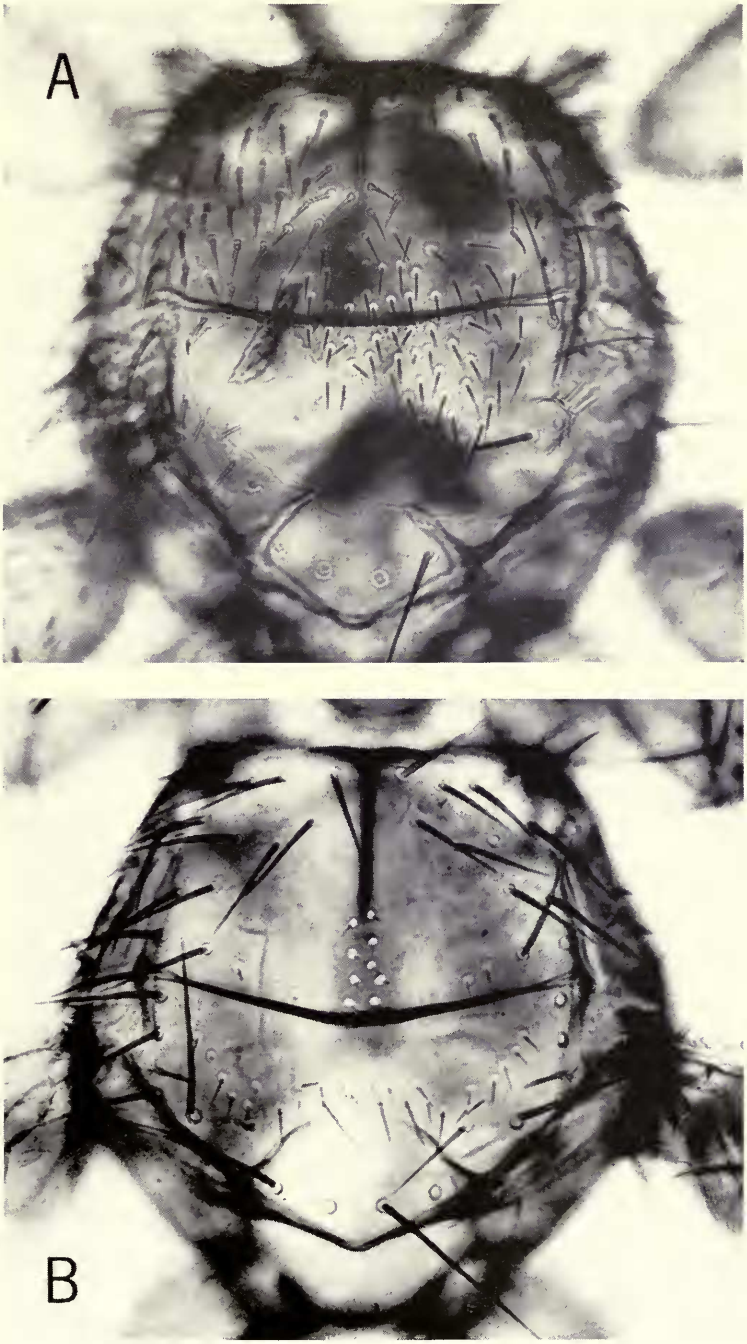

Fig. 67. Thorax, dorsal view. A, *T. dunni*, new species, holotype. B, *T. costalimai* Guimarães.

Trichobius dugesii group

The species of this group are closely related to and probably derived from those of the *longipes* group. They differ in that the median pleurotrochantinal lobe, if present, is not united with the metepimeron and sternum VI is absent in some species. As in the *longipes* group, the female cerci are not united with the ventral arc. The species may be segregated into two complexes. The median pleurotrochantinal lobe is present in one, absent in the other.

Trichobius dugesii complex

In the species of this complex, a blunt pleurotrochantinal lobe is present but is not united with the metepimeron and sternum VI is present in the males of all excepting *T. macrophylli* n. sp. The species occur on bats of four subfamilies of Phyllostomidae: *T. dugesii* Townsend on *Glossophaga soricina* (Glossophaginae); *T. joblingi* n. sp. on *Carollia perspicillata* (Carolliinae) and sometimes on *Trachops cirrhosus* (Phyllostominae) with which *perspicillata* often roosts; *T. macrophylli* n. sp. on *Macrophyllum macrophyllum* (Phyllostominae); *T. urodermae* n. sp. on *Uroderma bilobatum* (Stenoderminae).

Trichobius urodermae Wenzel, new species. Figures 66B, 68I.

Superficially resembling females of *Trichobius longipes* (Rudow) but differing markedly in that the median pleurotrochantinal lobe is not united with the metepimeron as in that species. From other species of the *dugesii* group that have a median pleurotrochantinal lobe, it may be distinguished by its larger size, the very long antero-lateral prescutal setae, and the distinctive male gonapophyses.

DESCRIPTION: *Head.*—Slightly wider than long. Laterovertices and occipital plates well differentiated, the occiput slightly elevated above the rest of the head. Eyes with about nine large convex facets. Palpi rounded-oval, ventral surface with short setae, upper surface microsetose. Theca pyriform. *Thorax.*—Anterior margin of prescutum slightly projecting at middle, the median suture incomplete, usually extending less than half the distance to transverse suture, the latter slightly angulate, not well-defined at middle. Mesonotum as illustrated (fig. 66B); with a median area of dense finer setae, separated from anterior margin by three rows of very long setae that are two to three times as long as median setae, and separated from lateral margin by two longitudinal rows of long setae; antescutellar setae at least twice as long as the scutal setae anterior to them; microsetae present along dorsal edge of anepisternum and along thickened pigmented lateral margin of prescutum and scutum. Median pleurotrochantinal lobe well developed, blunt, translucent, reflexed dorsally. *Wings.*—Costa with long macrosetae basally, these becoming progressively shorter apically, more or less uniform from about mid-length to apex; base of R_1 usually with three macrosetae, united with costa at a point approximately midway between second and third crossvein. *Legs.*—Fore- and midlegs typical of *longipes* group. Apical patch of dense fine setae on inner edge of hind tibiae not well defined. Tarsi compressed antero-posteriorly; hind tarsi (not including claws) about half as long as tibiae.

Abdomen.—Lateral lobes of tergum I+II each with lateral cluster of 12–15 coarse setae, the inner (upper) margin of each lobe, anterior to this cluster, with a row of one to three fine setae. Sternum I+II setose in a broad triangular area and along lateral margins near apex; the marginal setae slightly longer toward sides; posterior margin feebly emarginate. *Female:* Tergum VII a narrow transverse strip with a longer seta

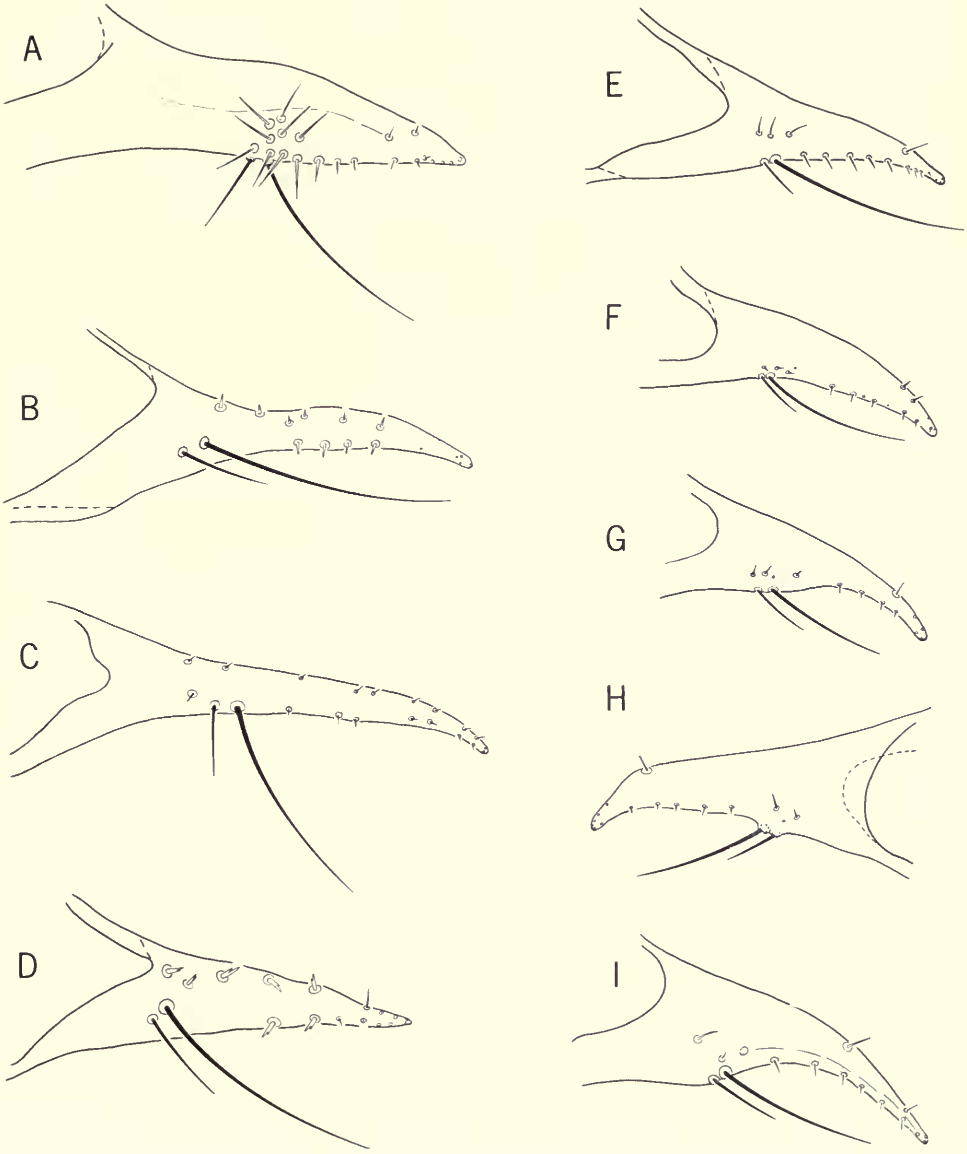

Fig. 68. Male gonapophyses (left, except as indicated), lateral view, *Trichobius dugesii* group. A, *T. parasiticus* Gervais. B, *T. diphyllae,* new species, holotype. C, *T. furmani,* new species, host unknown, Vitoc Valley (Junín), PERU. D, *T. dugesioides,* new species, holotype. E, *T. joblingi,* new species, composite, but based chiefly on holotype. F, *T. macrophylli,* new species, paratype from *M. macrophyllum* (no. 4741), Fort Davis (Canal Zone). G, left, and H, right gonapophyses, *T. dugesii* Townsend, from *Glossophaga s. leachii* (no. 5027) Fort Kobbe Beach (Canal Zone). I, *T. urodermae,* new species, paratype from *Uroderma bilobatum,* Almirante (Bocas del Toro).

on each side and a shorter pair medially and slightly posteriorly. Supra-anal plate with four apical macrosetae and two shorter setae on each side, one of these often inserted ventrad. Sternum I+II with weakly developed microsetae. Seventh sternites with about 17 setae, the apical setae longest, one conspicuously longer than the others. Subapical, ventro-lateral macroseta of connexivum absent. *Male:* Sternum I+II with distinct short transverse rows of microsetae. Discal setae of sternum V gradually longer toward apex, those of the apical margin considerably longer than the discals, those toward sides at least twice as long as the median setae. Sternum VI thread-like, barely visible. Hypopygium with numerous coarse setae. Gonapophyses as in fig. 68I; ventral macroseta not reaching apex, the accessory seta inserted immediately proximal to the macroseta; two or three smaller setae inserted above ventral pair, a row of extremely fine setae along ventral margin; dorsal margin with a seta at angulation and another minute one near apex.

Measurements:	BL	TL	WL	WW
Male	1.46–1.84	0.62–0.65	1.32–1.39	0.58–0.71
Female	1.62–2.17	0.66–0.71	1.52–1.59	0.66–0.77

TYPE MATERIAL: Holotype male (slide) from *Uroderma bilobatum* (host no. 5528), Almirante (Bocas del Toro), 5 February 1960, C. M. Keenan and V. J. Tipton. Allotype female, same host (no. 6958) and collectors, Rodman Naval Base (Canal Zone), 27 April 1961. In the collection of Chicago Natural History Museum.

Paratypes from *Uroderma bilobatum,* 22 (13 lots from 13 bats) as follows: 2 (2 bats), type locality, 26 and 28 January 1960; 8, Fort Clayton (Canal Zone), 28 November 1960; 1, Fort Davis (Canal Zone), 22 September 1960; 2 (2 bats), palm tree, Fort Randolph (Canal Zone), 6 October 1959; 1, Summit Gardens (Canal Zone), 11 September 1959; 2, Punta Piña (Darién), 24 March 1960; 6 (3 bats), Armila (San Blas), 18 March to 1 April 1963, C. O. Handley, Jr. and F. M. Greenwell. Paratypes to be deposited in the collections of Chicago Natural History Museum; the United States National Museum; the Gorgas Memorial Laboratory, Panamá; the Environmental Health Branch (U. S. Army) at Corozal (Canal Zone); Departamento de Zoologia, Secretaria de Agricultura, São Paulo; and Facultad de Ciencias, Universidad Central de Venezuela, Caracas.

REMARKS: This species is known to us only from *Uroderma bilobatum* and is one of the relatively few species of *Trichobius* known from bats of the subfamily Stenoderminae.

Trichobius dugesii Townsend. Figures 68G,H; 69A.

Trichobius dugesii Townsend, 1891, Ent. News, 2: 106—Guanajuato, Mexico, ex *Glossophaga soricina* (Snow Entomological Museum, University of Kansas, Lawrence). Van der Wulp, 1903, Biol. Centr.-Amer., Ins. Dipt., 2: 432. Aldrich, 1905, Smiths. Misc. Coll., 46: 657 (part.). Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 14, 15 (part.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth. Wash., no. 155, p. 655 (part.). Guimarães, 1938, Revista Mus. Paulista 23: 656 (part.); 1941, Papeis Avulsos, 1: 213–214 (part.). Schuurmans Stekhoven Jr., 1941, Zool. Anz., 136: 79. Bequaert, 1942, Bol. Ent. Venez., 1: 87 (part.). Hoffmann, 1953, Mem. Congr. Cient. Mex., 7: 181, 186 (part.). Jobling, 1949, Parasitology, 39: 316 ff., 326 (part.). Goodwin and Greenhall, 1961, Bull. Amer. Mus. Nat. Hist., 122: 245.

Trichobius blandus Curran, 1935, Amer. Mus. Novit., no. 765, pp. 9 (keyed), 10 (descr.), fig. 11—Paraíso [Canal Zone], Panama, ex *Glossophaga soricina leachii* (American Museum of Natural History). Jobling, 1938, Parasitology, 30: 358 (part., ex *G. soricina*). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 318 (part.). Schuurmans Stekhoven Jr., 1951 (and 1941?), Beiträge Fauna Perus, 3: 95.

At least six species have been confused under this name in the literature. Among these are *T. joblingi* n. sp., *T. dugesioides* n. sp., *T. longipes* (Rudow) (= *T. mixtus* Curran) and several undescribed species. It is nearly impossible to determine which published references should be assigned to this name. As indicated elsewhere, the species treated as *dugesii* by Jobling (1938) is *T. longipes,* while the species figured and described by him as *T. blandus* (not Curran, 1935) is *T. joblingi* n. sp. However, Jobling's records (loc. cit.) of *blandus* from *Glossophaga soricina* apply to *dugesii.*

Although closely related to some of the species listed above, *dugesii* is easily distinguished by the combination of: extremely short antescutellar setae (fig. 69A); its translucent, rounded, median pleurotrochantinal lobe; the distinctive gonapophyses and the presence of sternum VI, in the male.

PANAMANIAN MATERIAL EXAMINED: A total of 109 specimens in 63 lots. From *Glossophaga soricina leachii,* 103 flies (59 lots) from 63 bats, as follows: 1, San Lorenzo Cave, Fort Sherman (Canal Zone), 29 March 1960; 2, Fort Sherman, 4 December 1959; 1, Galeta Island (Canal Zone), 19 November 1959; 4, France Field (Canal Zone), 30 November 1959; 5, Fort Kobbe Beach (Canal Zone), 16 November 1959; 8, Coco Solo ammunition area (Canal Zone), 20 October 1959; 3, Empire Range (Canal Zone), 30 September 1959; 5, Fort Clayton (Canal Zone) 14 September and 5, same locality, 13 October 1959; 4, Fort Davis (Canal Zone), 18 November 1959 and 2, same locality, 20 September 1960; 2, Camp Chagres, Madden Dam (Canal Zone), 25 June 1963; 1 [holotype of *T. blandus* Curran], Paraíso (Canal Zone), 17 October 1930, L. H. Dunn #7 [AMNH]; 4, Chepo (Panamá), 24 May 1960; 2 (2 bats), Chilibrillo Caves (Panamá), 28 October 1959 and 2 August 1960; 1, Huile (Panamá), ? 24 October 1960; 2, west side of Taboga Island (Panamá), 24 September 1959; 3 [paratype females of *T. blandus* Curran], Bella Vista, near Panamá (Panamá), 25 June 1931, L. H. Dunn [AMNH]; 9, Guánico (Los Santos), 28 January 1962; 1, Cerro Hoya (Los Santos), 10 February 1962; 1, Santa Clara (Coclé), 27 October 1959; 8, Río Hato (Coclé), 22 October 1959; 18, Santa Clara (Coclé), 27 October 1959; 2, Río Tuira (Darién), 10 March 1958, Pedro Galindo [GML]; 7, Río Mandinga (San Blas), 30 May 1957, P. Galindo [GML]; 2, Almirante (Bocas del Toro), 1 February 1960.

From a mixed collection of (12) *Carollia p. azteca* and (6) *Glossophaga s. leachii:* 1, Huile (Panamá), October 1960. From *Carollia p. azteca* (?): 1, Gatun Tank Farm (Canal Zone), 19 November 1959. From *Trachops cirrhosus:* 6, Río Mandinga (San Blas), 30 May 1957, P. Galindo [GML].

OTHER MATERIAL EXAMINED: From *Glossophaga s. leachii:* 2, Mineral Montechristo (Moragan), EL SALVADOR, 18 June 1953, H. Felten [SM]; 2, near Santa Tecla (Libertad), EL SALVADOR, H. Felten [SM]; 4, Finca El Zapote, Zapote (Escuintla), GUATEMALA, 7 July 1948, L. de la Torre and R. D. Mitchell, CNHM Guatemala Zoological Expedition (1948). From *Glossophaga s. valens:* 1, from preserved bat collected at Vitoc Valley, Tarma Province (Junin), PERU, by F. Woytkowski [CNHM].

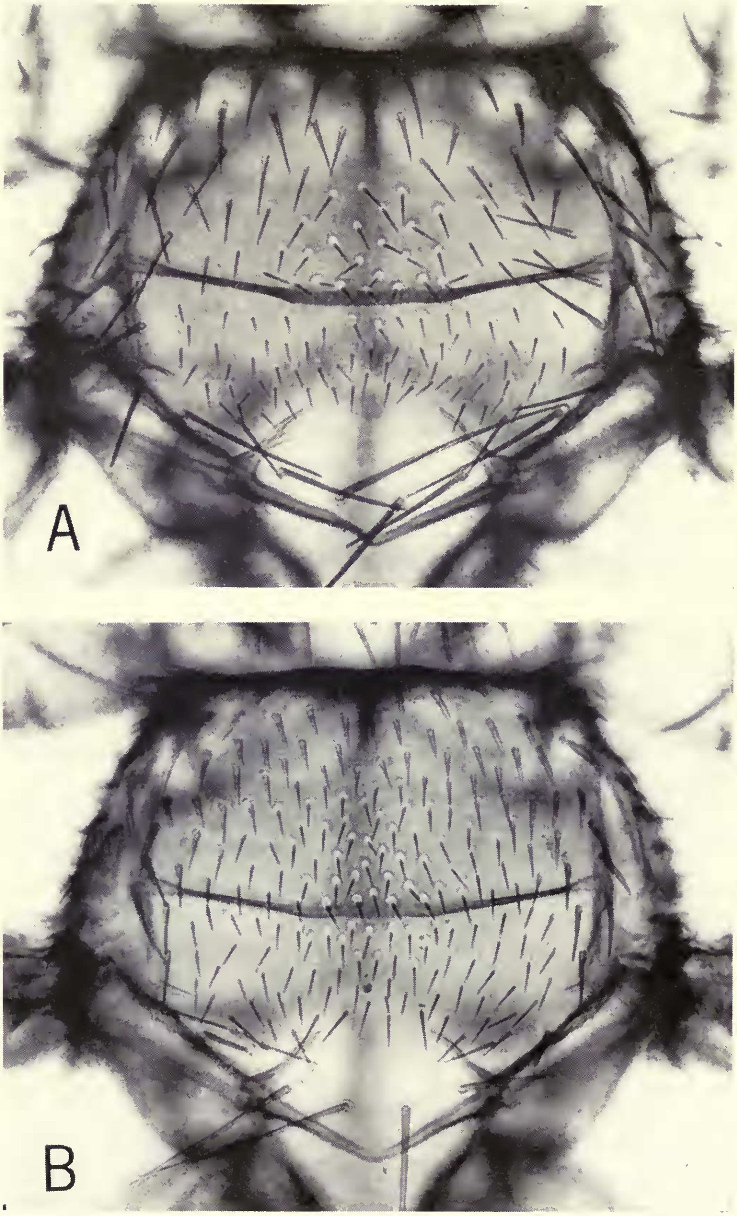

Fig. 69. Thorax, dorsal view. A, *Trichobius dugesii* Townsend; B, *Trichobius macrophylli*, new species; both from *Macrophyllum macrophyllum* (no. 4749), Fort Davis (Canal Zone).

REMARKS: *Trichobius dugesii* appears to be restricted to *Glossophaga soricina,* though it is possible that it may occur on other species of *Glossophaga.* None were obtained from numerous specimens of *G. commissarisi* collected in Panama. It is possible that *dugesii* may occasionally transfer to other hosts, but there is no evidence that this is so. Those collected in Panama from the mixed host series are probably from the specimens of *Glossophaga.* The specimens from *Carollia p. azteca* were doubtfully associated with the host by the collectors. Those taken from *Trachops* were a part of a collection that contained several obviously incorrect host associations, probably due to mislabeling.

It is obvious that Guimarães (1938), Bequaert (1942), Jobling (1938 and 1949), and Hoffmann (1953) treated *dugesii,* in part, but probably only the specimens they recorded from *Glossophaga soricina.* Guimarães (loc. cit., pl. 2, fig. 6) figured as *dugesii* a species with long antescutellar setae, from *Carollia perspicillata.* It was probably *T. joblingi* n.sp.

Trichobius joblingi Wenzel, new species, Figures 68E, 70.

Trichobius dugesii (not Townsend 1891), Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 16, pl. 1, fig. 1 (part.?); Curran, 1935, Amer. Mus. Novit., no. 765, p. 9 (part.?). Bequaert, 1942, Bol. Ent. Venez., **1**: 87 (part.?). Guimarães, 1938, Rev. Mus. Paulista, **23**: 656 (part.) pl. 2, fig. 6 (?). 1941, Papeis Avulsos, **1**: 215 (part.). Cooper, 1941, Yearb. Amer. Phil. Soc., **1941**: 124, 126 (part.?) Jobling, 1949, Parasitology, **39**: 316 ff., 326 (part.).

Trichobius blandus (not Curran, 1935), Jobling, 1938, Parasitology, **30**, pp. 365 (keyed), 385 (descr.), fig. 13. Bequaert, 1940, Rev. Acad. Colomb. Cienc. Ex., Fis. y Nat., **3**: 418 (part.) Starrett and de la Torre, 1964, Zoologica, **49**: 58.

T. joblingi n.sp. is closely related to *T. dugesii* Townsend and *T. macrophylli* n.sp. From *dugesii* it may easily be distinguished by: the long antescutellar setae, which in *joblingi* are from two and one half to three times as long as the scutal setae immediately anterior to them (subequal to scutal setae in *dugesii*); the presence in the female, posterior to the lateral lobes of tergum I+II, of a cluster of three to five setae which are coarser and longer than the others (none conspicuously longer in *dugesii*); the shorter setae of tergum VII (female); and by characters of the male gonapophyses. From *macrophylli* it may be separated by its longer antescutellar setae (less than twice as long as anterior scutal setae in *macrophylli*); the much smaller eyes and relatively longer occipital plate, the eyes viewed from above being shorter than greatest length of occipital plate (as long as or longer than occipital plate in *macrophylli*); and by having only three to five coarser lateral connexival setae in the cluster behind tergum I+II (10–13 in *macrophylli*).

In the following description, we have added characters not given by Jobling and emphasized others.

DESCRIPTION: Laterovertices, occipital plates, upper surface of palpi, upper edges of mesepisterna, outer edges of prescutum on basal third, and outer edges of scutum microsetose, in addition to the metanotum and laterotergites, connexivum of abdomen, and the abdominal sclerites (excepting tergum I+II). *Head.*—Eyes relatively small, shorter (viewed from above) than greatest length of occipital plate; with ± 10 small facets. *Thorax.*—Median discal setae rather abruptly shorter and denser than those lateral and anterior to them, limited on prescutum to basal half or less and separated from the lateral margins by about three rows of longer setae; antescutellar setae conspicuously and abruptly longer (usually two and one half to three times) than the scutal setae immediately anterior to them. Median pleurotrochantinal lobe rounded, translucent, slightly reflexed.

Abdomen.—Inner (dorsal) margin of each lateral lobe of tergum I+II (anterior to the cluster of coarse setae) with two or three fine setae in a single row. Dorsal connexivum of abdomen with three pairs of minute "segmental" setae. Sternum I+II well developed, broader than pleurotrochantines, with nearly uniform setae arranged in a broadly triangular area and, along lateral margins on basal half. *Female:* Connexivum on each side posterior to lateral lobes of tergum I+II, with a cluster of from three to five setae which are conspicuously coarser and/or longer than the others; on each side anterior to the seventh sternite is a latero-ventral apically directed macroseta. Tergum VII feebly differentiated but represented by two pairs of minute setae, the anterior pair slightly more widely separated, the posterior pair close behind them. Supra-anal plate with four apical macrosetae and on each side at middle, a shorter seta; occasionally an additional short seta is present on each side medial to the lateral seta. Seventh sternites with about ten setae of varying lengths, the basal ones short, the apical ones macrosetae, one twice as long as next longest setae. *Male:* Sternum V feebly sclerotized, as wide as abdomen, its posterior margin broadly and feebly emarginate, the setae rather uniform throughout, except along posterior margin where five or six bristles on each side are about twice as long as the others. Sternum VI present, thread-like. Hypopygium bluntly conical, with numerous macrosetae. Gonapophyses (viewed dorsally), asymmetrical and curved to the left; ventral margin appearing straight in lateral view (fig. 68E).

Measurements:	BL	TL	WL	WW
Male	1.21–1.48	0.47–0.49	1.00–1.07	0.45–0.55
Female	1.26–1.70	0.52–0.55	1.15–1.26	0.49–0.60

TYPE MATERIAL: Holotype male and allotype female (slides) from *Carollia perspicillata azteca* (host no. 4899), railroad culvert east of Summit Golf Club (Canal Zone), 26 October 1959, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—1870 specimens (334 lots, 614 bats) from *Carollia perspicillata azteca:* 29 (10 bats), Brazoa Brook (Canal Zone), 6 October 1959; 56 (6 bats), Coco Solo (Canal Zone), 13 January 1960, and 2, same locality, 8 December 1960; 5 (8 bats), Curundu (Canal Zone), 14 September 1959; 105 (37 bats), Fort Davis, various dates, October and November 1959, and 14 (8 bats), same locality, various dates, September and November 1960; 2, Fort Clayton (Canal Zone), 14 September 1959; 16 (28 bats), Fort Gulick (Canal Zone), various dates, September and October 1959; Fort Randolph, 1 October 1959; 207 (174 bats), Fort Sherman (Canal Zone), various dates, March through December, 1959–61; 185 (67 bats), France Air Force Base (Canal Zone), various dates, August to November 1959; 9 (3 bats), Galeta Island (Canal Zone), 19 November 1959; 21 (8 bats), culvert, Gatun Tank Farm (Canal Zone), 19 November 1959; 36, hollow tree, 1 mi. from Gatuncillo (Canal Zone ?), 28 July 1960; 10, Farfan (Canal Zone), 19 December 1915, T. Hallinan; 274 (51 bats), mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 9 September and 25 November 1959; 12 (1 bat), Navy By-Pass Road (Canal Zone), 8 October 1959; 5 (2 bats), Navy Tank Farm, 6 October 1959; 6 (3 bats), railroad culvert, Paraíso (Canal Zone), 15 and 16 September 1959; 270 (17 bats), railroad culvert, east of Summit Golf Club (Canal Zone), 26 October 1959; 46 (2 lots), Summit (Canal Zone), 17 April 1957, C. B. Koford [USNM]; 106 (34 bats), Sardanillo Caves, Summit (Canal Zone), 12 August 1961, C. Yunker [RML]; 41 (9 bats), culvert, Rousseau Road, 13 October 1959; 2, Piña Field range, 27 September 1960; 43, house, Camp Piña (Canal Zone), 26 October 1960; 17 (4 bats), Camp Chágres, Madden Dam (Canal Zone), 20 to 25 June 1963, GML; 41, Gamboa (Canal Zone), 1 May 1957 [USNM]; 14 (3 lots), Barro Colorado Island (Canal Zone), 2 January, 19 February, and 5 April 1957 [USNM]; 2, Arraiján (Panamá), 26 March 1961; 59 (27 bats), air-raid shelter, La Chorrera (Panamá), 18 September 1959; 135 (17 bats), culverts, Chepo Road (Panamá), 8 and 12 October 1959; 2 (2 bats), Chilibrillo Caves (Panamá), 28 October 1959; 2, same locality, 2 August 1960; 17 (29 bats), same locality, 18 August 1959; 3, same locality, 27 August 1944 [USNM]; 3, "Ft. Lorenzo, Panama" [USNM, det. as *T. dugesii* by Q. C. Kessel]; 15 (5 bats), Isla Taboga (Panamá), 24 September 1959; 61 (57 bats), various dates, September and November 1959, Buena Vista Caves (Colón); 1, culvert, Río Hato Road (Coclé), 22 October 1959; 16 (4 bats), Puenta de Cocos, Isla del Rey (Darién), 22 and 23 March 1960; 16, Piña Point (Darién), 23 and 24 March 1960; 9, Río Chucunaque (Darién), 19 February 1958, Pedro Galindo [GML]; 9 (3 bats), Río Tuira (Darién), 25 February to 2 March 1958; 1, Río Seteganti, February 1961; 27 (11 bats), Guánico (Los Santos), 21 to 28 January 1962; 10 (8 bats), near Río Guánico, Guánico, (Los Santos), 8 February to 1 March 1962; 6 (4 bats), Cerro Hoya, 10 to 25 February 1962; 80 (22 bats), Almirante (Bocas del Toro), 23 January to 1 February 1960. Paratypes in the collections listed on p. 410.

OTHER PANAMANIAN MATERIAL EXAMINED (272 specimens): From *Carollia castanea,* 78 flies (23 lots from 27 bats) as follows: 25 (8 bats), Sibube (Bocas del Toro), 17 to 26 January 1963, C. O. Handley, Jr.; 2, Río Tuira (Darién), 26 January 1958, P. Galindo [GML]; 2, Río Chucunaque (Darién), 17 February 1958, P. Galindo [GML]; 1, Tacarcuna (Darién), 19 June 1963, GML; 4 (2 bats), La Laguna (Darién), 2900 feet elevation, 3 and 9 June 1963 [GML]; 40 (15 bats), Armila (San Blas), 23 February to 29 March 1963, C. O. Handley, Jr. From *Carollia subrufa,* 44 flies (13 lots from 16 bats) as follows: 12 (2 bats), Sibube (Bocas del Toro), 22 and 23 January 1963, C. O. Handley, Jr.; 8 (1 bat), Isla Bastimentos (Bocas del Toro), 3 February 1963, C. O. Handley, Jr.; 26 (5 bats), Cayo Agua (Bocas del Toro), 12 and 16 February 1963, C. O. Handley, Jr.; 19 (7 bats), Armila (San Blas), 25 February to 20 March 1963, C. O. Handley, Jr.; 1, La Laguna (Darién), 2900 feet elevation, 29 May 1963, GML. From *Carollia* sp.: 1, Barro Colorado Island (Canal Zone), 13 February 1957 [USNM]; 7, Albrook Field (Canal Zone), 14 January 1963 [USNM]; 37, Cerro Tigre (Canal Zone), 15 January 1953 [USNM]; 1, Río Tuira (Darién), 25 February 1958, P. Galindo [GML]; 23, culvert, Chepo Road, near Pacora (Panamá), 11 April 1961, C. Yunker [RML]. From mixed collections of *Carollia p. azteca* and *Glossophaga s. leachii:* 60, Huile (Panamá), 24 October 1960; 21, San Lorenzo Cave, Fort Sherman (Canal Zone), 15 March 1961. From *Artibeus j. jamaicensis:* 2, Almirante (Bocas del Toro), 23 January and 18 February 1960; 3 (2 lots), cave, west side of Taboga Island, 24 September 1959. From *A. lituratus palmarum:* 6, Cerro Azul (Panamá), 25 January 1958, E.

Méndez [GML]. From *Chiroderma villosum jesupi:* 1, Almirante (Bocas del Toro), 23 January 1960. From *Desmodus rotundus murinus:* 1, Almirante (Bocas del Toro), 31 January 1960; 13 (2 bats), Guánico (Los Santos), 26 January and 1 February 1962. From *"Dirias":* 2 (2 lots), Summit (Canal Zone) 17 April 1957, C. B. Koford (USNM). From *Glossophaga soricina leachii:* 5 (4 bats), Almirante (Bocas del Toro), 26 to 30 January 1960; 9, Gamboa (Canal Zone), 17 April 1957, C. B. Koford [USNM]. From *Lonchophylla robusta:* 4 (16 bats), Buena Vista Caves (Colón), 16 June 1960. From *Lonchorhina aurita:* 6 (5 bats), mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 9 September 1959; 19 (11 bats), same locality, 25 November 1959; 4 (2 bats), railroad culvert east of Summit Golf Club (Canal Zone), 26 October 1959; 21, 2 miles north of Summit, 17 April 1957. From *Macrophyllum macrophyllum:* 6 (3 bats), Fort Gulick (Canal Zone), 15 September 1959; 1, Fort Davis (Canal Zone), dock 46, 13 October 1959. From *Micronycteris nicefori* [mist net]: 4 (2 bats), Armila (San Blas), 28 March 1963, C. O. Handley, Jr. From *Natalus stramineus mexicanus:* 3, San Lorenzo Cave, Fort Sherman (Canal Zone), 15 March 1961. From *Phyllostomus hastatus panamensis:* 1, Natural Bridge, Madden Dam (Canal Zone), 31 August 1959; 9, Guánico (Los Santos), 26 January 1962; 3, Chilibrillo Caves (Panamá), 17 July 1959; 1, Farfan (Canal Zone), 19 December 1915, T. Hallinan. From *Pteronotus parnellii fuscus:* 1, culvert, Paraíso (Canal Zone), 1 December 1959; 1, mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 25 November, 1959; 11 (5 bats), railroad culvert east of Sumit Golf Club (Canal Zone); 1 Buena Vista (Colón), 3 September 1959; 7 [ex *"C.r. rubiginosa"*], Chilibrillo River (Panamá), 22 September 1923 [USNM]. From *Tonatia silvicola:* 1, Armila (San Blas), 22 March 1963, C. O. Handley, Jr. From *Trachops c. cirrhosus:* 14 (3 bats), culvert, Chepo Road (Panamá), 8 and 12 October 1959; 5 (2 bats), Río Mandinga (San Blas), 30 May 1957, P. Galindo [GML]. From *Uroderma bilobatum:* 1, Fort Randolph (Canal Zone), 6 October 1959. From *"bat":* 3 (2 lots), Gamboa (Canal Zone), 12 December 1961; 3, Buena Vista (Colón), 3 September 1959; 5, Curundu (Canal Zone), 7 October 1960. *Without specific host or locality:* 15, from "culvert of RR" [USNM].

NON-PANAMANIAN MATERIAL EXAMINED: We have examined more than 500 additional specimens of *joblingi*, mostly from *Carollia perspicillata*, taken at various localities in GUATEMALA, BRITISH HONDURAS, EL SALVADOR, COSTA RICA, COLOMBIA, VENEZUELA, TRINIDAD, TOBAGO, SURINAM, BRAZIL and PERU. Only a few specimens were from hosts other than species of *Carollia*, including: 3 from *Myotis* sp. (!) in Venezuela; 1 from *Rhogeesa io* (!) in Trinidad; 1 each from *Lampronycteris platyceps, Glossophaga s. soricina, Desmodus r. rotundus* and *Phyllostomus h. hastatus* in Trinidad; and 3 obviously mislabeled specimens from *Molossus major* in Surinam.

REMARKS: As noted above, *T. joblingi* n.sp. is the species figured by Jobling (1938) as *T. blandus* (not Curran 1935). Mr. Jobling informed us (*in. litt.*) that he redescribed *blandus* from two specimens collected by Dunn from *Glossophaga soricina* and *Carollia perspicillata* in the Canal Zone. His figure is of *joblingi* and not of *dugesii* Townsend (= *blandus*

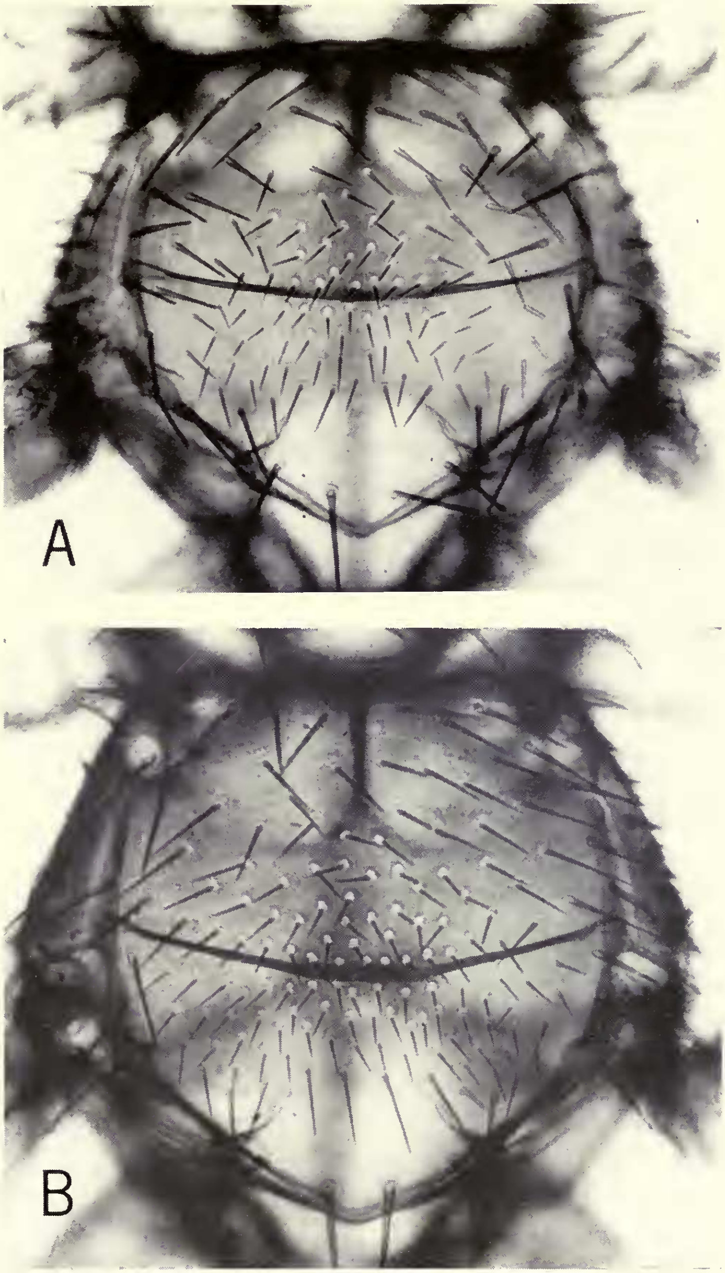

Fig. 70. *Trichobius joblingi*, new species. Thorax, dorsal view. A, male from unidentified discarded host (no. 4168), Buena Vista (Colón). B, female from *Carollia p. azteca* (no. 4628), Brazoa Brook (Canal Zone).

Curran). However, his specimen from *Glossophaga soricina* was probably *dugesii.* Most published records of *dugesii* from *Carollia perspicillata* are actually based on specimens of *joblingi.*

Jobling (op. cit.) described the posterior margin of sternum V as being "strongly emarginated in the middle." We have not found this to be true in the specimens examined by us, though idiosyncrasies of mounting may sometimes make it appear so in slide preparations.

T. joblingi appears to be primarily a parasite of bats of the genus *Carollia.* Records from other hosts seem for the most part to represent transitory associations, disturbance transfers, and contaminations. Some represent errors of association or labeling. Temporary associations with a number of hosts are to be expected of the parasites of a ubiquitous host like *C. perspicillata* which roosts with such a great variety of other bats. It is evident from the field data that, in most instances, the other hosts from which *joblingi* was taken in Panama were roosting in the same sites as *C. perspicillata.* We do not believe that it normally occurs on these hosts (with the possible exception of *Trachops*) in the absence of *Carollia.*

Carollia perspicillata is the most widely distributed, abundant and ubiquitous bat in Central and South America, and *Trichobius joblingi* n. sp. is the most abundant streblid parasite on that host. It constituted 74% of all Streblidae taken on *perspicillata.* It occurred on 76.7% of all individuals of this host collected and on 91.54% of all those parasitized by Streblidae. The average number of specimens taken per individual parasitized bat was 3.8.

Trichobius joblingi is named after Mr. B. Jobling, formerly of the Wellcome Institute of Tropical Medicine, in recognition of his outstanding contributions to the systematics and morphology of blood-sucking Diptera, especially of the Streblidae.

Trichobius macrophylli Wenzel, new species. Figures 68F, 69B.

Very similar to *T. joblingi* n. sp. and *T. dugesii* Townsend and, like them, possessing a blunt translucent median pleurotrochantinal lobe, but differing in possessing a more convex and rounded mesothorax and much more evenly distributed mesonotal setae, which become longer much more gradually towards sides and anterior margin. The antescutellar setae are intermediate in length between those of *joblingi,* and *dugesii.* In the female, posterior to lateral lobes of tergum I+II, there are 9–13 connexival setae that are coarser and longer than the others (three to five in *joblingi,* none conspicuously longer in *dugesii*).

DESCRIPTION: Nearly identical to *joblingi* but differing in the following characters: *Head.*—Eyes relatively large and conspicuous, as long as or longer than occipital plates (shorter in *joblingi*), with about 11 large convex facets. *Thorax.*—Mesonotal setae (fig. 69B), short at middle, becoming gradually longer toward sides and anterior margin; antescutellar setae less than twice as long as scutal setae immediately anterior to them. Median pleurotrochantinal lobe translucent, short, truncate or slightly emarginate at middle, feebly reflexed. *Wings.*—R_s, typically, slightly shorter than distance from fork to crossvein *r-m*. *Abdomen.*—Lateral lobes of tergum I+II with from two to five fine setae in a single row along inner (upper) margin. Dorsal connexivum with only one or two pairs of minute segmentally arranged setae. *Female:* Dorso-lateral and ventral connexival setae subequal; immediately posterior to lateral lobes of tergum I+II, with a lateral cluster of from 9–13 setae which are conspicuously coarser and/or longer than the others; a ventro-lateral subapical macroseta present. Tergum VII with one or two pairs of minute setae usually arranged in a transverse row, the inner pair sometimes slightly displaced posteriorly. Seventh sternites with 11–13 setae. *Male:* Dorso-lateral connexival setae longer than ventrals. Sternum V complete, the median apical marginal setae a little longer than the discals, those at sides conspicuously longer. Sternum VI absent. Gonapophyses as in fig. 68F.

Measurements:	BL	TL	WL	WW
Male	1.10–1.40	0.44–0.47	1.10–1.24	0.52–0.58
Female	1.10–1.57	0.47–0.55	1.26–1.40	0.55–0.66

TYPE MATERIAL (1185 flies in 46 lots from 79 *Macrophyllum macrophyllum*) : Holotype, male and allotype female (slides) from host no. 4741, dock 45, Fort Davis (Canal Zone), 13 October 1959, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—787 (33 bats), same data as the holotype; 295 (3 lots, 28 bats), same locality, 7 and 29 January 1960; 89 (14 bats), Natural Bridge, Madden Dam (Canal Zone), 31 August 1959; 12 (2 bats), Chepo Road, culvert, 12 October 1959; 2, Armila (San Blas), 23 February 1963, C. O. Handley, Jr. and F. M. Greenwell. Paratypes deposited in the collections listed on page 410.

OTHER MATERIAL EXAMINED: From *Carollia perspicillata azteca:* 1, Natural Bridge, Madden Dam (Canal Zone), 31 August 1959; 1, railroad culvert east of Summit Golf Club (Canal Zone), 26 October 1959. From *Lonchorhina aurita:* 1 (9 bats), mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 25 November 1959. *"Sobre Chiroptera"*: 37, Lago de Valencia, VENEZUELA, 25 August 1948, J. Racenis [FCUCV].

REMARKS: This fly is apparently restricted to *Macrophyllum macrophyllum.* The other two host records seem to represent strays or contaminations.

Trichobius parasiticus complex

In species of this complex, the pleurotrochantinal lobe is completely absent, sternum VI is absent in the male, and the male gonapophyses show greater modification in shape and chaetotaxy than in the *dugesii* complex. The mesonotal micropile is more extensive in several of the species than in any others of the *dugesii* group.

Four species occur on Desmodidae, including *T. diphyllae* n. sp. from *Diphylla ecaudata* in Mexico and Guatemala and Venezuela; an undescribed species from *Diaemus youngii* in Trinidad; *T. furmani* n.sp., from *Desmodus rotundus* and *Glossophaga soricina* in Amazonian Colombia, Paraguay, and Peru; and *T. parasiticus,* which appears to be primarily a parasite of *Desmodus rotundus,* from Mexico to Trinidad, Brazil and Peru. A fifth species, *T. dugesioides*—on *Trachops cirrhosus, Chrotopterus auritus* and *Carollia perspicillata*—is known to us from Guatemala to Panama. Within this complex, *T. dugesioides* has the least modified mesonotal chaetotaxy, while *parasiticus* and the undescribed species from *Diaemus* exhibit the greatest reduction of these setae. The male gonapophyses of *parasiticus* are the most highly modified of any known species of *Trichobius.*

Trichobius dugesioides Wenzel, new species. Figures 68D, 71.

Very similar in apearance, though apparently not closely related, to *T. joblingi* n. sp., and often occurring together with that species on the same host. Unlike *T. joblingi,* it lacks a median pleurotrochantinal lobe and lacks sternum VI (in the male). It also differs in shape and chaetotaxy of the male gonapophyses and in the length of wing vein R_s in relation to the distance between fork and crossvein *r-m.* In *dugesioides,* the gonapophyses are straight (not sinuate) in dorsal view and have short thorn-like setae (very fine short hair-like setae in *joblingi*). The mesonotal chaetotaxy differs in that the antescutellar scutal setae are not as a rule abruptly longer than the scutal setae immediately anterior to them, as they are in *joblingi.*

DESCRIPTION: *Head.*—Laterovertices and occipital plates well differentiated. Eyes with ± ten facets. *Thorax.*—Mesonotal chaetotaxy as shown in fig. 71, the antescutellar setae less than twice as long as the other scutal setae immediately anterior to them (two to three times as long in *joblingi*). Microsetae of prescutum extending inwardly from cleft to a little beyond first longitudinal row of setae along lateral margin. Pleurotrochantines without apical median lobe, instead slightly emarginate at middle with a conspicuous seta on each side of emargination. *Wings.*—R_s markedly shorter than distance between fork and crossvein *r-m* (subequal in *joblingi*).

Abdomen.—Tergum I+II very similar to that of *joblingi.* Sternum I+II with setae of apical margin markedly longer toward the sides (only very slightly longer in *joblingi*). Dorsal connexivum with four pairs of minute dorsal segmental setae. *Female:* supra-anal plate with four apical macrosetae, without short marginal or discal setae (a short seta on each lateral margin in *joblingi*); seventh sternites with 13–15 bristles. Dorsolateral and ventral connexival setae subequal, excepting a cluster of conspicuously longer setae behind the lateral lobes of tergum I+II. A long latero-ventral macroseta on each side anterior to the seventh sternites. *Male:* Dorso-lateral connexival setae longer than ventral connexival setae. Sternum V with apical setae longer than discals and becoming conspicuously longer toward sides. Sternum VI absent. Gonapophyses not sinuate in dorsal view, narrowly wedge-shaped in lateral view, the ventral margin nearly straight; with numerous short thorn-like setae; accessory setae nearly half as long as macrosetae.

Measurements:	BL	TL	WL	WW
Male	1.26–1.40	0.49–0.55	1.07–1.15	0.52–0.60
Female	1.40–1.70	0.55–0.60	1.10–1.26	0.58–0.65

TYPE MATERIAL: 230 flies in 20 lots (35 bats), from *Trachops c. cirrhosus.* Holotype male, allotype female, Chepo Road (Panamá), 12 October 1959, V. J. Tipton and C. M. Keenan. In the collection of Chicago Natural History Museum. Paratypes.—105 (8 bats), same data but 8 and 12 October, and 94 (15 bats), 24 May 1960; 5 (3 bats), Cerro Hoya (Los Santos), 15 and 24 February 1962; 2, Río Mandinga (San Blas), 30 May 1957, GML; 2 (2 bats), Armila (San Blas), 16 March 1963, C. O. Handley, Jr. and F. M. Greenwell.

From *Carollia perspicillata azteca*: 124 specimens in 56 lots from 148 bats, as follows: 1, Camp Piña (Canal Zone), 26 October 1960; 10 (6 bats), air raid shelter, Fort Davis (Canal Zone), 6 October 1960, and 5 (7 bats), 29 October 1959; 1, same locality, 17 November 1960; 1, Fort Sherman (Canal Zone), 18 October 1960; 17 (30 bats), same locality, 2 and 4 December 1959; 3 (2 bats), San Lorenzo Cave, Fort Sherman, 15 and 29 March 1960; 22 (16 bats), mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 9 September 1959; 16 (14 bats), same locality, 25 November 1959; 1, culvert, Brazoa Brook, Navy Tank Farm (Canal Zone), 6 October 1959;

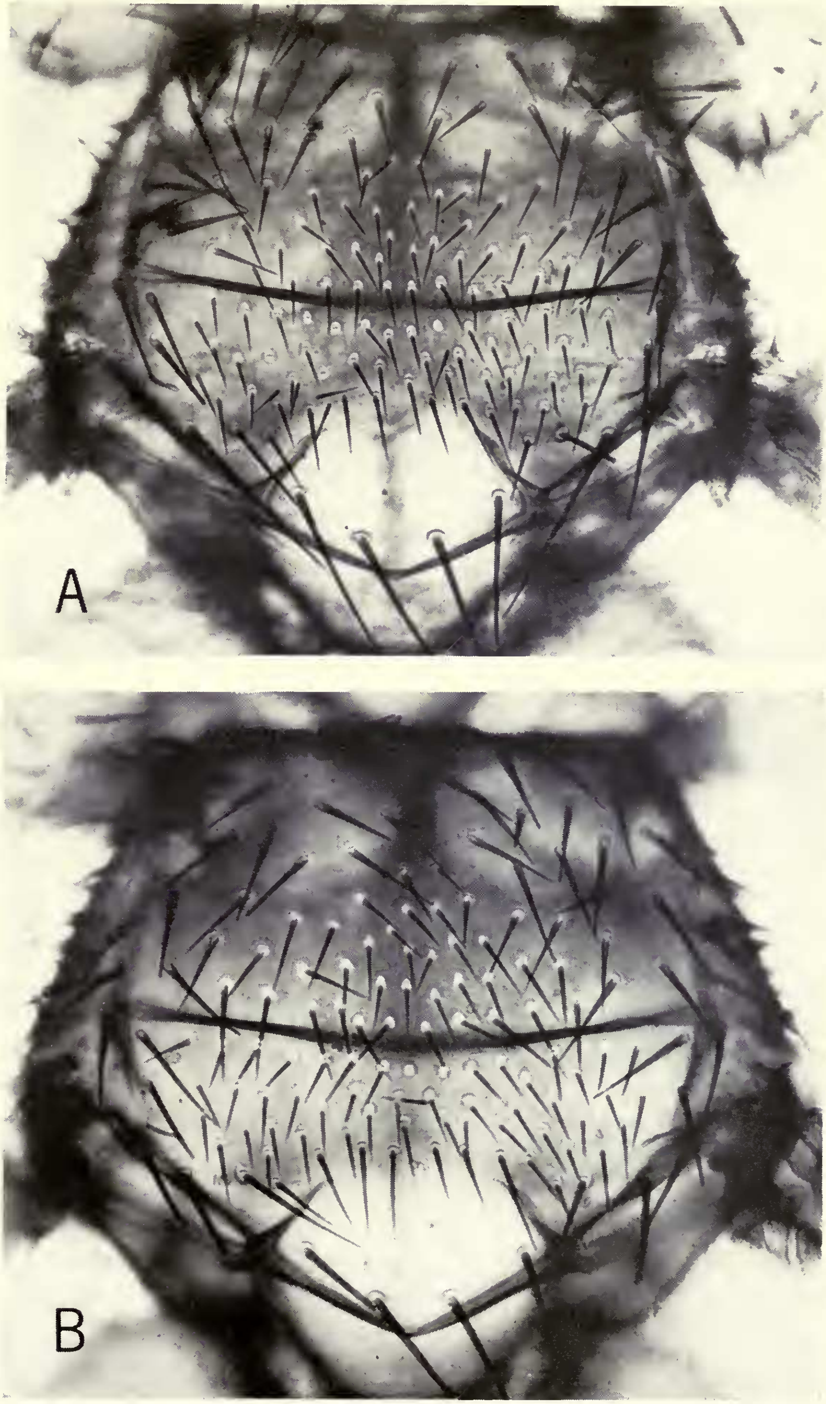

Fig. 71. *Trichobius dugesioides*, new species, thorax, dorsal view. A, male paratype (host no. 4639) and B, female paratype (host 4690), both from *Trachops c. cirrhosus*, Chepo Road (Panamá).

3, Juan Mina (Canal Zone), 28 July 1960; 1, Piña Field Range (Canal Zone), 27 September 1960; 3 (2 bats), Camp Chágres [Boy Scout Camp], Madden Dam (Canal Zone), 20 June 1963 [GML]; 1, Chilibrillo Caves (Panamá), 2 August 1960; 6 (29 bats), same locality, 18 August 1959; 1, culvert, Chepo Road (Panamá), 12 October 1959; 4 (3 bats), Buena Vista (Colón), 3 and 15 September 1959; 11 (20 bats), same locality, 24 November 1959; 5 (3 bats), Cerro Hoya (Los Santos), 8, 18, and 23 February 1962; 2, Río Setegantí (Darién), 5 February 1961; 2 (4 bats), Piña Point (Darién), 24 March 1960; 8 (3 bats), Almirante (Bocas del Toro), 28, 30, and 31 January 1960. Paratypes in the collections listed on p. 410.

OTHER PANAMANIAN MATERIAL EXAMINED.—From *Chrotopterus auritus:* 5 (3 bats), Armila (San Blas), 7, 15 and 19 March 1963, C. O. Handley and F. M. Greenwell. From *Lonchorhina aurita:* 1, mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 9 September 1959; 6 (19 bats), same locality, 25 March 1959; 4, Rancho Mojica (Bocas del Toro), 4800 feet elevation, 8 September 1961. From a bat doubtfully identified as *Tonatia* sp.: 6, Tacarcuna (Darién), 4 September 1958, Pedro Galindo [GML]. From *Natalus stramineus mexicanus:* 1, Fort Sherman (Canal Zone), 17 March 1960. From mixed collections of (12) *Carollia p. azteca* and *Glossophaga s. leachii:* 1, Huile (Panamá), 24 October 1960; of (3) *C. p. azteca* and (7) *G. s. leachii:* 2, San Lorenzo Cave, Fort Sherman (Canal Zone), 15 March 1961; of *Natalus stramineus mexicanus* and *Carollia* sp.: 1, same locality and date. We have also seen specimens from NICARAGUA and GUATEMALA, which we refer to as *dugesioides.*

REMARKS: The records of *dugesioides* from hosts other than *Trachops cirrhosus, Chrotopterus auritus,* and *Carollia perspicillata* are probably in error or represent contaminations or transitory associations. In all likelihood, the true hosts are *Trachops* and *Chrotopterus,* closely related genera of Phyllostominae. *T. dugesioides* consistently occurs on *Carollia perspicillata,* which commonly roosts in the same places as *Trachops,* and it appears that these two bats "exchange" *Trichobius* to a considerable extent (see "Host-parasite Relationships," below.) On the other hand, *dugesioides* has not been taken from either *C. castanea* and only once from *C. subrufa,* species which are ecologically more restricted than *perspicillata.* The other streblids characteristic of *perspicillata* occur on all three hosts.

Trichobius furmani Wenzel, new species. Figures 68C, 72.

Superficially very closely resembling *joblingi,* especially in mesonotal chaetotaxy; differing from that species in that it lacks a median pleurotrochantinal lobe, by the absence of sternum VI in the male, and the male gonapophyses being straight rather than curved in dorsal view and long and feebly curved in lateral view rather than wedge-shaped. It may be easily separated from *dugesioides,* to which it is related, by the extremely long antescutellar bristles, some of which are three or four times as long as the scutal setae immediately anterior to them (less than twice as long in *dugesioides*); the extensive microsetose area on the prescutum; and the lack of thorn-like setae on the gonapophyses.

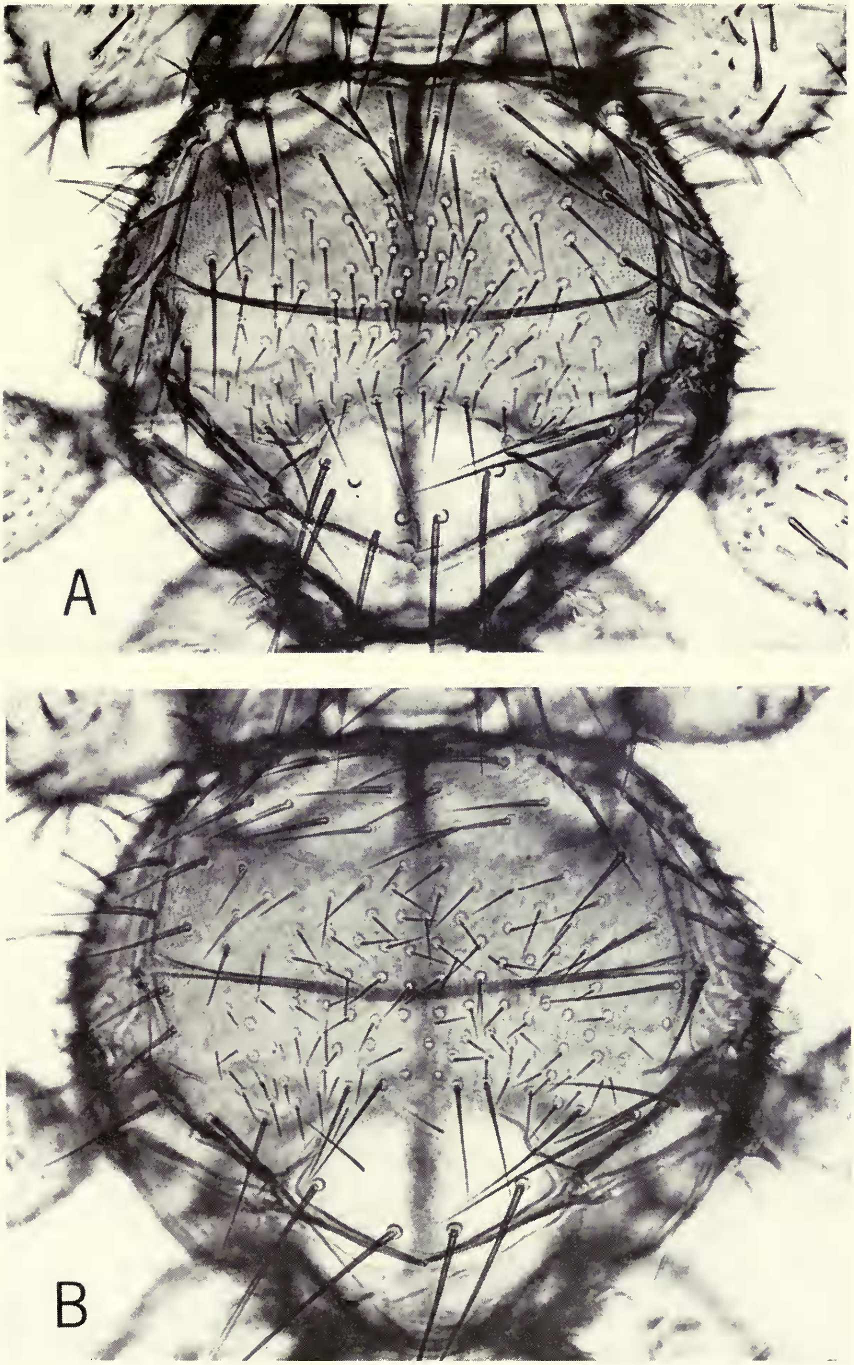

Fig. 72. *Trichobius furmani*, new species, thorax, dorsal view. A, male. B, female. From Vitoc Valley (Junín), PERU (host unknown).

DESCRIPTION: *Head.*—As in *joblingi* and related species. Theca cordiform. Eyes with ± 11 facets. *Thorax.*—Prescutum, with anterior margin slightly projecting at middle; sides and anterior half with very long bristles, the discal setae short and denser and longer than discal scutal setae; microsetose area extending inwardly on prescutum to second (longitudinal) row of setae, excepting along transverse suture where it is feebly developed nearly to fourth row of setae; on anterior half of prescutum the microsetae extend inwardly about halfway to the median suture, but are so feebly developed as to be detectible only under oil immersion or very high "dry" magnification. Antescutellar scutal bristles very long, the longest ones two and one-half to four times as long as the setae anterior to them. *Wings.*—R_s shorter than distance from fork to crossvein *r-m.*

Abdomen.—Tergum I+II with one to three short setae on anterior face on each side (between base and coarse setae of lateral lobe); inner dorsal margin of each lateral lobe with three to five fine setae in a single row. Abdominal connexivum with two pairs of dorsal segmental setae. Sternum I+II as in *T. dugesioides.* *Female:* Tergum VII with two pairs of setae; the outer, anterior pair a little less than half as long as apical macrosetae of supra-anal plate; the posterior pair close together, a little less than half as long as outer pair. Supra-anal plate with four apical macrosetae, without short setae on disk or lateral margins. Seventh sternites with about 15 setae. Connexivum with a ventro-lateral subapical macroseta on each side. *Male:* Sternum V as in *T. dugesioides.* Sternum VI absent. Gonapophyses (fig. 68C) long, straight in dorsal view, feebly curved apically in lateral view; ventral macrosetae very long, extending beyond apices of gonapophyses; accessory setae very short.

Measurements:	BL	TL	WL	WW
Male	1.26–1.40	0.48–0.51	1.07–1.55	0.52–0.60
Female	1.40–1.70	0.52–0.56	1.10–1.26	0.58–0.65

TYPE MATERIAL: Holotype male and allotype female from *Desmodus rotundus* (Sanborn field no. 2942), Segrario (Puno), PERU, 13 October 1941, C. C. Sanborn. In the collection of Chicago Natural History Museum.

Paratypes.—From *Desmodus rotundus*: 7, same data as the holotype. From specimens and wrappings containing a mixed collection of *Desmodus rotundus, Phyllostomus hastatus, Carollia perspicillata, Glossophaga soricina, Tonatia silvicola* and *Vampyrops fumatus:* 232, Vitoc Valley, Province Tarma (Junín), PERU, various dates, July to October 1940, F. Woytkowski. From *Diphylla ecaudata:* 4, Cerro de las Pinturas, upper Río Iniride (Vaupés), COLOMBIA, 2–3 February 1957, Fred Medem. Paratypes to be deposited in the collections listed on p. 410.

OTHER MATERIAL EXAMINED: From *Glossophaga soricina soricina:* 1, Rückenau, Friesland Colony near Itacurubi del Rosario, PARAGUAY, 14 June 1960, S. L. Loewen.

REMARKS: Of the 232 specimens taken from the wrappings and specimens of the mixed lot of bats collected by F. Woytkowski, 220 are labeled as having been taken from the specimens of *Desmodus rotundus.* The records suggest that *furmani* may be a parasite of Desmodidae and may replace *T. parasiticus* on these bats in some parts of South America.

Trichobius furmani is named after Prof. Deane Furman, University of California at Berkeley, in recognition of his outstanding contributions to the study of ectoparasites.

Trichobius diphyllae Wenzel, new species. Figures 68B, 73A.

Apparently related to *dugesioides* and *furmani* and like them, having the male gonapophyses straight in dorsal view. As in *dugesioides* the gonapophyses have short thorn-like setae in addition to the two pairs of ventral setae. Also distinguished from other species of the group by the very minute, fine, discal mesonotal setae as well as by the very extensive microsetose area on the prescutum.

DESCRIPTION: *Head.*—Broader than long (to base of occiput), with well-differentiated laterovertices and occipital lobes. Eyes with ± 10 facets. Palpi short, roundly-oval. *Thorax.*—Microsetose area of prescutum extending inwardly from longitudinal membranous fissure to third longitudinal row of setae on basal half, and about two-thirds the distance to median suture on anterior half. Disk of prescutum and scutum with extremely fine, short setae; with long sparse setae (fig. 73A) laterally and anteriorly. Anterior projection of sternopleura truncate; posterior margin of pleurotrochantines without a median reflexed lobe. *Wings.*—Length of R_s only slightly shorter than distance between fork and crossvein *r-m.*

Abdomen.—Tergum I+II with a single short seta on anterior face; inner dorsal margin with about five fine setae between base and cluster of coarse setae on lateral lobe. Sternum I+II, with setae of apical margin only slightly longer laterally than medially; postero-lateral angles with extensive setose area. Dorsal connexivum with four pairs of minute segmentally arranged setae. *Female:* Dorso-lateral connexival setae conspicuously shorter than the ventrals; lateral connexival setae behind the lobes of tergum I+II a little longer than those posteriorly but not forming a conspicuous cluster; a subapical ventro-lateral macroseta present on each side. Tergum VII variable in shape, longer than broad, with a longer seta along each lateral margin at about mid-length, and a pair of shorter subapical more closely spaced setae. Seventh sternites with about 15 setae, the apical ones macrosetae. *Male:* Lateral connexival setae of about same size as ventrals. Sternum V, at middle, with apical marginal setae distinctly longer than discal setae and becoming more than twice as long as the discals toward the sides. Sternum VI absent. Gonapophyses as in fig. 68B. Aedeagus rod-shaped, finely pointed at tip.

Measurements:	BL	TL	WL	WW
Male	1.48–1.62	0.48–0.54	1.17–1.32	0.60–0.63
Female	1.37–1.73	0.51–0.55	1.21–1.37	0.62–0.69

TYPE MATERIAL: Holotype and allotype from *Diphylla ecaudata centralis* (CNHM host nos. 73191–94, 73345–46), San Lorenzo, four miles northeast of Volcan de Jumay (Jalapa), GUATEMALA, elevation 5700–5750 feet, 15 February 1952, Luis de la Torre, CNHM Guatemala Zoological Expedition (1951–52). In the collection of Chicago Natural History Museum.

Paratypes.—From *Diphylla ecaudata centralis:* 9, same data as the holotype; 1, same data but 13 February 1952; 9, Finca Recreo, Municipio Yepocapa (Chimaltenango), GUATEMALA, elevation 4400 feet, 11 May 1948, R. L. Wenzel and Luis de la Torre, CNHM Guatemala Zoological Expedition (1948); 62, same data but 25 October 1948, R. D. Mitchell and L. de la Torre. From *Diphylla ecaudata:* 1, Pueblo Nuevo Xcan (Quintana Roo), Yucatan Peninsula, MEXICO, 29 July 1962, Ticul Alvarez; 5, Felipe Carrillo Puerto (Quintana Roo), Yucatan Peninsula, MEXICO, 16 August 1962, J. Knox Jones, Jr.; 7, El Limon, Rancho Grande (Aragua), VENEZUELA, 30 March 1960, C. O. Handley, Jr. [USNM]. Paratypes to be deposited in the collections listed on page 410.

REMARKS: This fly was not taken from the specimens of *Diphylla ecaudata* that were collected in Panama. However, it was taken in Venezuela, Guatemala, and Mexico, and thus it seems reasonable to expect that it will also be found in Panama, as was *Strebla diphyllae* n.sp. (q.v.) a characteristic parasite of the same host.

Trichobius parasiticus Gervais. Figures 68A, 73B.

Trichobius parasiticus Gervais, 1844, Atlas Zool., p. 14, pl. 43.—"Guiane," from *Desmodus rufus.*—Costa Lima, 1921, Arch. Esc. Sup. Agric. Vet. Med., 5: 18–20 (part.). Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 14 (keyed), 15 (records). Speiser, 1900 (part.), Arch. Naturg., 66A, Bd. I, pp. 32 ff. (morph., etc.), 59–60 (discuss., synonymy), 62 (cit.), 65 (keyed), figs. 5–9; 1907, Ent. News, 18: 104 (cit.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., no. 155, p. 655. Curran, 1935, Amer. Mus. Novit., no. 765, pp. 8 (keyed), 11. Guimarães, 1938, Rev. Mus. Paulista, 23: 657 (synonymy, discuss.), 662 (keyed), figs. 7, 8. Jobling, 1938, Parasitology, 30: 364 (hosts), 365 (keyed), 381 (redescr.), fig. 11. Mazza and Jörg, 1939, Mis. Estud. Pat. Reg. Argent., Publ. no. 41, pp. 87–93, figs. 1–3, 5–6 (morph.). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 418. Jobling, 1949, loc. cit., 39: 316 ff. (hosts), 326 (records); 1951, Trans. Roy. Ent. Soc. Lond., 102: 215 (morph.). Hoffmann, 1953, Mem. Congr. Cient. Mex., 7: 181 (keyed), 186 (records), pl. 4, fig. 4. Goodwin and Greenhall, 1961, Bull. Amer. Mus. Nat. Hist., 122: 223, 269 (records).

Trichobius kesseli Guimarães, 1938, Rev. Mus. Paulista, 23: 660, pl. 3, fig. 9. Schuurmans Stekhoven Jr., 1951 (and 1941?), Beiträge Fauna Perus, 3: 95 (part.?).

Apparently the type of *T. parasiticus* no longer exists, but the interpretation of Kessel (op. cit.), followed by Curran (1935), Guimarães (1938), and Jobling (1938) is probably correct. The type and principal host, *Desmodus rotundus* (= *Desmodus rufus*) may carry another species, *T. furmani* n. sp. (q.v.) in some parts of South America, but the type of *parasiticus* was probably from a locality not far removed from the coast of "Guiane" and hence is almost certainly the species treated here. We have no specimens from French Guiana. When specimens are available, a neotype should be designated.

As with several of the past authors, Speiser's concept (1900, p. 59) of *T. parasiticus* included several species, among them *Strebla wiedemannii* Kolenati 1862 (= *Kolenatia wiedemannii* Rondani 1878, p. 169) and *T. dugesii* Townsend. His specimens from Cuba could not possibly be *parasiticus,* nor could *Trichobius parasiticus* of Newstead (1909–1910, p. 468) nor *Strebla wiedemannii* Kolenati 1862, because neither *parasiticus* nor its hosts occur in the Greater Antilles. Speiser (1902, p. 159) later erroneously synonymized *T. longipes* (Rudow) under *parasiticus.* Costa Lima's figure (1921, pl. 1, fig. 1) of a wing of *parasiticus* probably applies to a species of the *uniformis* group, if the setae of the sixth longitudinal vein are correctly shown.

The specimens identified as *parasiticus* by Bau (1929, p. 12), Dunn (1929, p. 504) and Bequaert (1933) have not been re-examined. Bau's record is without locality or host data. Dunn's record does not include a host identification. Bequaert's specimens from Yocat, Yucatan were from *Diphylla centralis* and thus could have been either *parasiticus* or *diphyllae* n.sp., though we doubt that he could have mistaken *diphyllae* for *parasiticus.*

T. parasiticus is easily recognized by the distinctive mesonotal chaetotaxy (fig. 73B) and male gonapophyses (fig. 68A). To the characters given by Jobling (1938), the following may be added.

Thorax.—Microsetose area of mesonotum extending from posterior margin of scutum to anterior margin of prescutum and inwardly to enclose the outer row of long prescutal setae and the setae of humeral callus. *Abdomen.*—Dorsal connexivum with four sets of

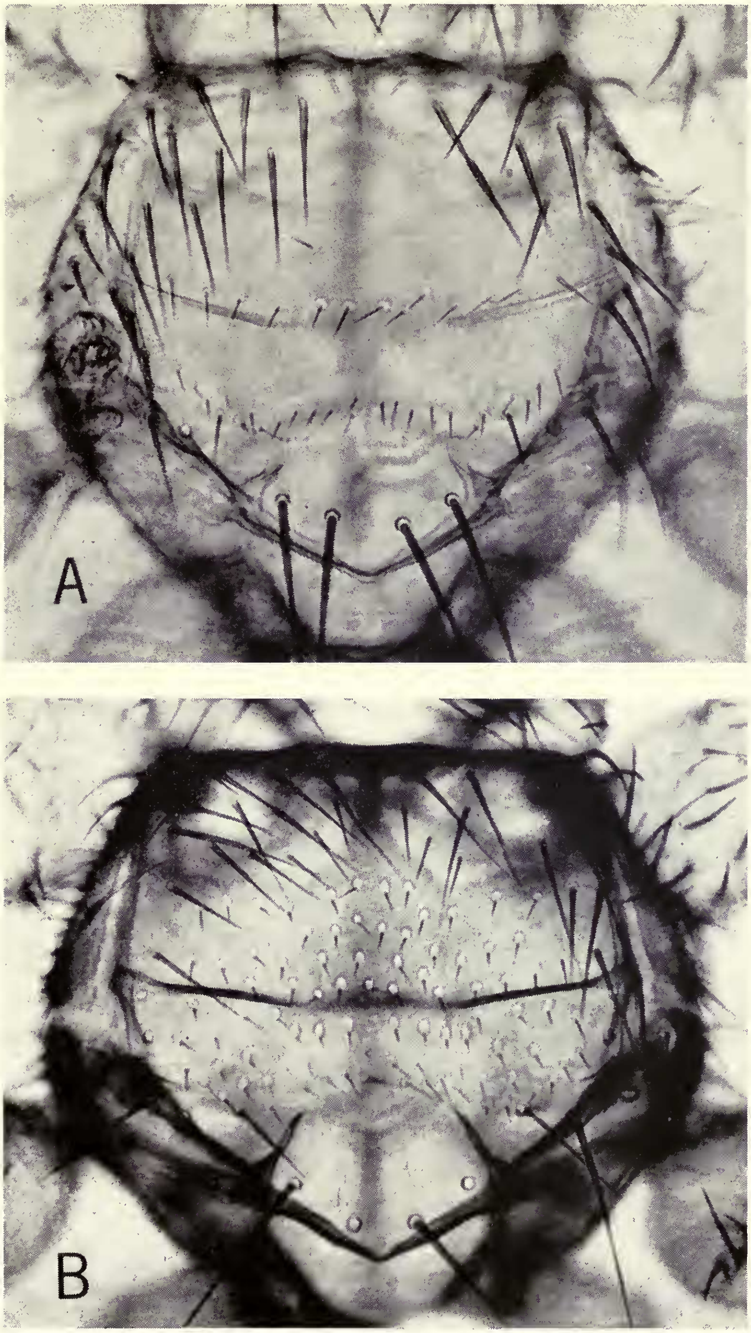

Fig. 73. Thorax, dorsal view. A, *Trichobius parasiticus* Gervais, male from *Desmodus r. murinus* (no. 9259) Guánico, (Los Santos). B, *Trichobius diphyllae*, new species, male paratype from *Diphylla ecaudata centralis*, Felipe Carrillo Puerto, Quintana Roo, MEXICO.

minute segmental setae, the anterior set consisting of two pairs, the three posterior sets of a single pair each. Upper inner margin of tergum I+II typically with two fine setae. Setae of sternum II extending anteriorly more than half the distance to base along lateral margins. *Female:* Tergum VII with two distal pairs of setae, the lateral pair coarse, about three times as long as inner pair and slightly anterior to them. Supra-anal plate with four apical macrosetae and, at mid-length, two to six short setae; when only two short setae are present, they are situated on each side near lateral margin (six short setae noted in only one specimen, taken from *Diaemus*). Seventh sternites with 16–17 setae, two or three of them macrosetae, one much longer than the others. Connexivum posteriorly with a ventro-lateral macroseta on each side; a cluster of about 20 setae is present on each side behind lateral lobes of tergum I+II distinctly longer than other dorso-lateral and lateral connexival setae, which are shorter than ventral connexival setae. *Male:* Apical margin of sternum V with setae about three times as long as discal setae, except for median pair, which are about twice as long as discals.

Measurements:	BL	TL	WL	WW
Male	1.42–1.57	0.45–0.49	1.10–1.11	0.58–0.60
Female	1.52–1.70	0.52–0.55	1.22–1.29	0.60–0.63

PANAMANIAN MATERIAL EXAMINED.—From *Desmodus rotundus murinus:* 258 specimens in 41 lots from 74 bats, as follows: 24, Casa Lewis, near Cerro Punta (Chiriquí), 5 February 1960; 11 (8 bats), hollow tree, Casa Tilley, near Cerro Punta, 6 February 1962; 8 (24 bats), same locality, 23 January 1960; 23 (12 bats), same locality, 6 and 11 March 1962; 167 (11 bats), Guánico (Los Santos), 26 January to 25 February 1962; 13 (6 bats), Almirante (Bocas del Toro), 23–31 January 1960; 11, Changuinola (Bocas del Toro), 27 February 1960; 25 (10 bats), Red Tank (Canal Zone), 27 January 1960; 1, Chilibrillo Caves (Panamá), 2 May 1957 (USNM). From *Diaemus youngii:* 2, Armila (San Blas), 4 March 1963, C. O. Handley, Jr. and F. M. Greenwell. From *Phyllostomus hastatus:* 1, Guánico (Los Santos), 26 January 1962. From *"Vampire Bats":* 1, Chilibrillo Caves (Panamá), 14 July 1945.

OTHER MATERIAL EXAMINED: Hundreds of specimens representing many lots from MEXICO, GUATEMALA, EL SALVADOR, COSTA RICA, COLOMBIA, VENEZUELA, SURINAM, TRINIDAD, BRAZIL and PERU. With few exceptions, these were taken from *Desmodus rotundus*, but *parasiticus* was taken together with *T. diphyllae* n.sp. on *Diphylla ecaudata* in Mexico and was found on *Diaemus youngii* in Panama.

REMARKS: As noted, *T. parasiticus* is primarily a parasite of *Desmodus rotundus* though it may occur on other Desmodidae, too. Records from other bats almost certainly represent strays, contaminations, or transitory associations. *Desmodus* often roosts near other bats.

Trichobius phyllostomae group

We have assigned four species to this group. They are *Trichobius phyllostomae* Kessel, *T. brennani* n.sp., *T. vampyropis* n.sp., and an undescribed species. Of these, *brennani* and *vampyropis* occur in Panama. The other two are known to us only from Brazil. The group may be characterized as follows:

Head.—Laterovertices and occipital plates differentiated. Eyes multi-faceted, with from 26 to 32 facets. *Thorax.*—Anterior margin of prescutum distinctly projecting at middle. Median discal mesonotal setae dense, inserted in distinct thecae. Stenopleural projection very strong, truncate. Median pleurotrochantinal lobe tapered and dorsally reflexed. *Legs.*—Relatively long; hind legs longest, the femora about as long as thorax; dorsal setae of tibiae conspicuous, two to three times as long as the other tibial setae. *Abdomen.*—*Female:* Cerci not united with the ventral arc. *Male:* Sternum V well developed, with very long apical macrosetae, these progressively longer laterally. Sternum VI absent. Gonapophyses dissimilar, the macroseta and accessory seta inserted distinctly more distad on the left gonapophysis than on the right.

Jobling (1938) referred *T. phyllostomae* to the group of species without well-differentiated laterovertices and occipital plates. In all our material of this group, these plates are differentiated, but are not as widely separated as in some other species.

Trichobius brennani, new species. Figures 62D, 74A, 75A, B.

Closely related to *T. phyllostomae* Kessel and differing from that species as follows: posterior margin of each occipital plate with only two minute setae rather than three or four; inner margin of lateral lobes of tergum I+II with only one row of short setae instead of two irregular rows; tergum VII (female) with only a single pair of minute setae, rather than two pairs medial and apical to the macrosetae; male gonapophyses curved apically and with only a few submarginal microsetae (fig. 75A, B), rather than wedge-shaped with a row of distinct marginal setae (fig. 75D).

DESCRIPTION: *Head.*—Funnel-shaped, viewed from above, slightly elevated behind, with laterovertices and occipital lobes differentiated (sometimes not appearing so in slide mounts because of clearing and because of the presence of microsetae on the postvertex and between the laterovertices and occipital lobes); laterovertices with seven bristles; occipital lobes with from 12–14 coarse setae and at middle of posterior margin two minute setae, one about twice as long as the other. Eyes prominent, extending slightly beyond margin, with 17–20 facets. Palpi horizontal, oval, microsetose on dorsal surface, ventral surface covered with setae, distal macroseta nearly twice as long as palpus. Theca cordiform, with about 20 setae, four to six along apical margin, four along basal margin, and ten on disk.

Thorax.—Mesonotum and chaetotaxy as shown in fig. 74A. Sternopleural projection strong, wide, truncate or feebly emarginate (fig. 62D), slightly reflexed dorsally. Median pleurotrochantinal lobe narrow, tapered distally, strongly reflexed dorsally. *Wings.*—As in *T. phyllostomae;* R_1 united with costa at a point just proximal to level of second crossvein; R_s shorter than distance between fork and crossvein *r-m*. *Legs.*—Relatively long, the fore-, mid-, and hindlegs, progressively longer. Femora and tibiae of each pair subequal, hind femora approximately as long as thorax. Femora nearly covered with setae, but bare along ventral tibial "groove" and basally on inner face of hind femora; with long fringing setae along dorsal and ventral outer margins, and along inner ventral margin as well on midfemora; setae elsewhere short, becoming gradually longer toward apices. Tibial setae distinctly longer dorsally than they are laterally and ventrally; denser along inner edge of hind tibiae but not forming a well-defined patch. Hind tarsi slender, about half as long as tibiae, first segment longer than broad; second and third segments subequal; fourth segment antero-posteriorly compressed dorsally; last segment somewhat compressed laterally, elongate, narrow, sides subparallel.

Abdomen.—Connexivum without setae along middle of dorsum except for four pairs of short, segmental setae; with short setae laterally and ventrally. Each lateral lobe of tergum I+II with about 19 strong setae and, along lower margin, about five short setae; inner upper margin with a row of four or five fine setae extending medially and anteriorly from the cluster of macrosetae. Sternum I+II slightly wider than pleurotrochantines, the setae distributed in a roughly triangular area; posterior margin with longer setae. *Female.*—Tergum VII short, nearly as wide as supra-anal plate, feebly sclerotized, with a macroseta situated on each lateral margin and a pair of short setae (one-third length of macrosetae) slightly medial and posterior to macrosetae. Supra-anal plate with four apical macrosetae, a short seta on each side, and another pair of widely separated short setae on disk at mid-length. Seventh sternites relatively small, nearly rounded, each with about 17–18 setae of varying lengths, one a conspicuously longer macroseta. *Male:* Sternum V well developed; setae progressively longer toward apex; with about 12 macrosetae along apical margin and usually two or more long sub-apical setae. Sternum VI absent. Gonapophyses (fig. 75A,B) very slender; downwardly curved apically, right gonapophysis a little more strongly so than the left, its ventral macroseta inserted at about basal third, the accessory seta at about mid-length; left gonapophysis with macroseta inserted slightly beyond middle, the accessory seta immediately anterior to it. Aedeagus flagelliform.

Measurements:	BL	TL	WL	WW
Male	2.03–2.17	0.66–0.82	1.82–2.03	0.77–0.88
Female	2.07–2.39	0.77–0.78	1.98–2.25	0.85–0.91

TYPE MATERIAL (from *Sturnira ludovici*): Holotype male and allotype female (slides), from host no. 10469, Casa Tilley, 5300 to 5600 feet elevation, near Cerro Punta (Chiriquí), 14 March 1962, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—47, as follows: 7, same data and host specimen as holotype and allotype; 2, same locality, 15 February and 23 April 1960; 7 (6 bats), same locality 6 and 11 March 1962; 4 (4 bats), Casa Lewis, near Cerro Punta, 5600–5700 feet elevation, 5 (5 bats), Bambito, near Cerro Punta, 5000–6000 feet elevation, 7 March 1962; 2 (2 bats), Rancho Caballero (Bocas del Toro), 5000 feet elevation, 11 September 1961; 5 (1 bat), Cerro Malí (Darién), 4100–4800 feet elevation, 9 February 1964, C. O. Handley, Jr.; 2, same locality and collector, 31 May 1963; 12 (3 bats), Cerro Tacarcuna (Darién), 4100–4800 feet elevation, 29 February, 4 and 7 March 1964, C. O. Handley, Jr. Paratypes to be deposited in the collections of Chicago Natural History Museum; the United States National Museum; The Museum of Comparative Zoology; the American Museum of Natural History; Gorgas Memorial Laboratory; Environmental Health Branch at Corozal (Canal Zone); British Museum (Natural History); Departamento de Zoologia, Secretaria da Agricultura, São Paulo, Brazil; and the Faculdad de Ciencias, Universidad Central de Venezuela, Caracas.

REMARKS: This is one of the few Streblidae collected only above 4000 feet. It was taken only from *Sturnira ludovici.* The type of *T. phyllostomae* (Kessel, 1925: p. 17) is "a female in the British Museum, off *Phyllostoma,* Humboldt, Brazil, July, 1916, W. Erhardt—1921–200." Through the courtesy of Dr. Harold Oldroyd, we received a female specimen from the same locality ("Humboldt, Sta. Cath., 7-VII-1918") from the collection of the British Museum (Natural History). It is a female and compares well with a male specimen in our collection taken from "*Artibeus j. literatus,*" at Joinville, Santa Catharina, Brazil. In both of these, as in the holotype, the upper inner margins of the lateral lobe of abdominal tergum I+II have an irregular double row of setae. In *T. brennani* n. sp. and in the undescribed species from Therezopolis (Rio de Janeiro), Brazil, there is only a single row. The specimen from Therezopolis was taken from a species of *Sturnira.*

It seems very doubtful that the type of *T. phyllostomae* was actually taken from a species of *Phyllostomus.* In one of the vials of specimens col-

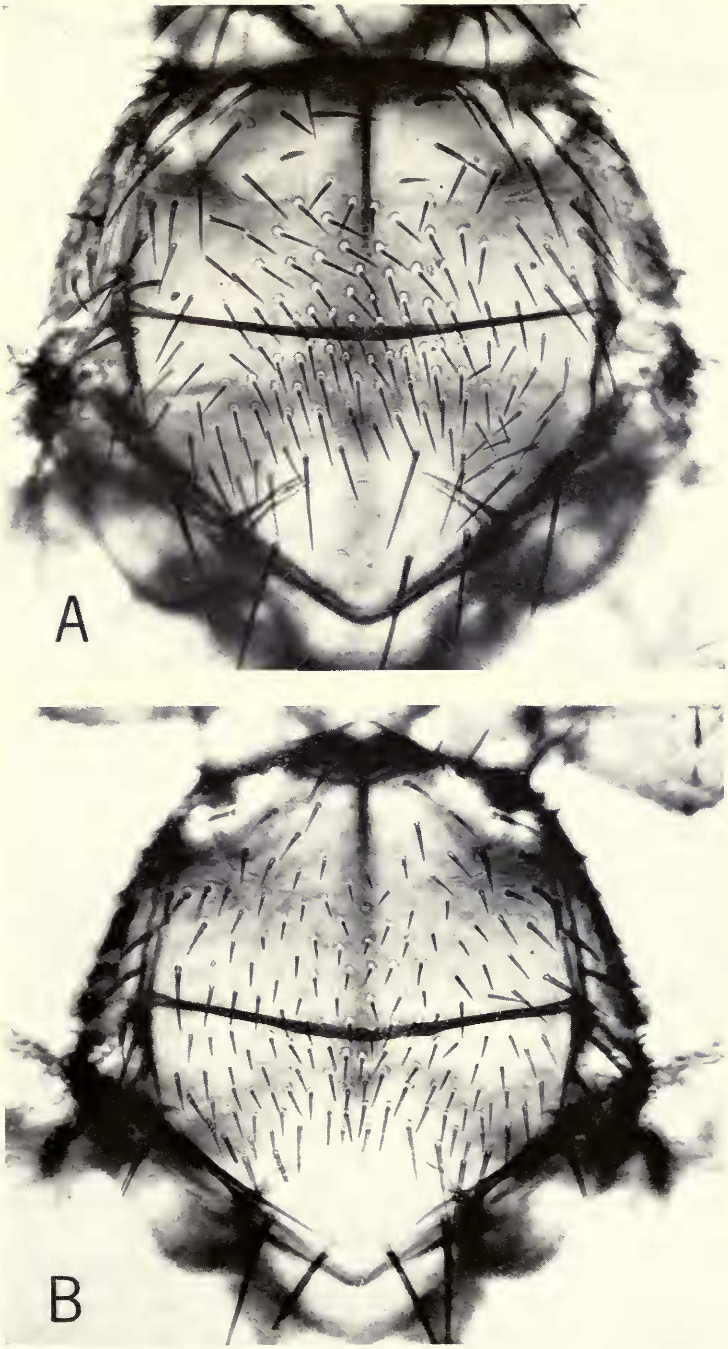

Fig. 74. Thorax, dorsal view. A, *Trichobius brennani*, new species, holotype male. B, *T. vampyropis*, new species, allotype female.

lected by Ehrhardt which contained *T. phyllostomae,* were examples of a species of *Megistopoda* and of *Aspidoptera phyllostomatis* (q.v.). These streblids appear to be restricted to *Artibeus* and *Sturnira.* The name *Phyllostomus* was loosely applied to phyllostomid bats until early in the Twentieth Century. The host of *T. phyllostomae* was probably a species of *Artibeus* or *Sturnira.*

T. brennani n.sp. is named after Dr. James Brennan of the Rocky Mountain Laboratory in grateful appreciation of many courtesies and in recognition of his contributions to our knowledge of the chigger mites.

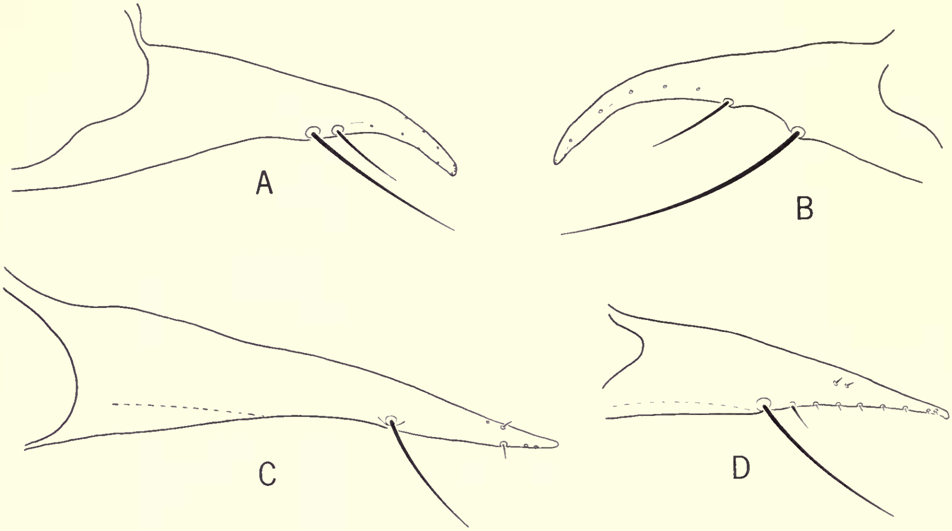

Fig. 75. Male gonapophyses (left unless otherwise noted), *Trichobius phyllostomae* group. A, and B (right gon.), *T. brennani,* new species, paratype from *Sturnira ludovici* (no. 8028), Rancho Mojica (Bocas del Toro). C, *T. vampyropis,* new species, paratype from *Vampyrops vittatus* (no. 8115), near Mojica (Bocas del Toro). D, *T. phyllostomae* Kessel, from "*Artibeus j. literatus,*" Joinville (Santa Catharina), BRAZIL.

Trichobius vampyropis Wenzel, new species. Figures 74B, 75C.

Distinctive in the very large number of eye facets (30–32), as in *brennani* n. sp. and *phyllostomae* Kessel (26–30); the very strongly projecting anterior margin of the prescutum; the markedly divergent fifth and sixth longitudinal wing veins; the very small female seventh sternites; the relatively narrow and long male sternum V with very long apical macrosetae; the distinctive male gonapophyses; the truncato-emarginate projection of the sternopleura and the very long, tapered, strongly reflexed median pleurotrochantinal lobe. Most nearly resembling *brennani* and *phyllostomae,* but in these smaller species the mesothorax is not as long and is more nearly quadrate; the anterior margin of the prescutum is less strongly projecting; the anterior margin of the sternopleura is truncate but not emarginate; the pleurotrochantinal lobe is short, translucent, and slightly bent but not ascending; the fifth and sixth longitudinal veins are not divergent; the setae of the tibiae are conspicuously longer; and the tarsi are less compressed antero-posteriorly.

DESCRIPTION: *Head.*—Funnel-shaped, convex. Eyes conspicuous, convex, projecting beyond margins of genae, with 30–32 facets. Laterovertices and occipital lobes well defined, separated; occipital lobes with 11 or 12 setae, the anterior ones conspicuously long macrosetae, the posterior setae shorter but coarse, excepting two minute setae near mesal edge of posterior margin. Palpi oval, horizontal, sparsely setose below. Theca pyriform. *Thorax.*—Sides distinctly converging anteriorly; anterior margin of prescutum strongly produced at middle, and distinctly emarginate at midline; median suture not reaching middle; mesonotal chaetotaxy as in fig. 74B. Sternopleura strongly produced anteriorly, the anterior margin relatively broad and distinctly, angulately emarginate. Median pleurotrochantinal lobe long, tapered, strongly reflexed dorsally and slightly overlapping the metapleuron, so as to appear united with it, though it is not. *Wings.*—Long, costal setae rather long basally, becoming shorter apically, of uniform length to apex from about middle of costal cell; R_1 united with costa opposite midpoint between second and third crossveins; R_s as long as or slightly longer than distance between fork and *r-m;* base of R_1 with three macrosetae, base of fourth longitudinal vein with one, of fifth with five or six; fourth and fifth veins diverging apically. *Legs.*—Fore- and midlegs subequal, the hind legs distinctly longer, though not markedly elongated. Tibiae uniformly clothed with short setae; femora with long and short setae, the macrosetae best developed on upper edges. Tarsi antero-posteriorly compressed, claws stout.

Abdomen.—Connexivum rather uniformly covered with relatively short setae, except along mid-dorsum, the setae borne on small, circular, sclerotized plaques. Lateral lobes of tergum I+II with numerous, heavy macrosetae. *Female:* Connexivum with four sets of minute dorsal segmental setae, the anterior three consisting of a single pair each, the posterior one of two pairs; without a ventro-lateral subapical macroseta. Tergum VII small, transverse, with four setae in a transverse row, the outer pair macrosetae, the inner pair a third or fourth as long as the outer. Supra-anal plate with four apical macrosetae and a single shorter seta on each side at mid-length. Seventh sternites small, each with about 13 setae of varying lengths, including several macrosetae, one of these twice as long as the next longest seta. *Male:* Sternum V relatively long, conspicuously narrower than abdomen, clothed with setae similar to those of connexivum, but with longer setae, including eight macrosetae, along apical margin; sternum VI absent. Sternum VII+VIII not well developed, with about eight dorso-lateral setae, including one very long macroseta on each side. Tergum IX with two transverse rows of macrosetae dorso-laterally and a third row between these ventrad. Gonapophyses as in fig. 74B.

Measurements:	BL	TL	WL	WW
Male	2.20–2.40	0.77–0.91	2.06–2.19	0.93–1.07
Female	2.31–2.65	0.82–0.95	2.25–2.31	1.03–1.06

TYPE MATERIAL: Holotype male and allotype female (on slides) from *Vampyrops vittatus* (host no. 8115) near Rancho Mojica (Bocas del Toro), 13 September 1961. In the collection of Chicago Natural History Museum. Two male paratypes, same data as the holotype; one male paratype, same host and collectors, Rancho Mojica, 12 September 1961; one male paratype, same host and collectors, Río Changena Camp (Bocas del Toro), 22 September 1961; three male paratypes from *Artibeus lituratus palmarum,* 22 miles south of Changuinola (Bocas del Toro), 7 September 1961. All specimens collected by C. M. Keenan, V. J. Tipton, and other personnel of the Environmental Health Branch. One each deposited in the collections of the United States National Museum, the Environmental Health Branch at Corozal (Canal Zone), and the Gorgas Memorial Laboratory, Panamá (Panamá).

REMARKS: The fact that many Streblidae have been collected from *Artibeus lituratus* in Panama and elsewhere without otherwise recovering this species suggests that the paratypes from Changuinola may have been mislabeled as to host.

The median pleurotrochantinal lobe is so long that in preserved specimens it reaches to or even slightly overlaps the metapleuron, and the abdomen of alcohol-preserved specimens must be manipulated in order to determine that the two structures are not united. In slide-mounted specimens, it may appear to be united with the metapleuron, even when the slide is viewed from an angle using a binocular dissecting microscope.

T. vampyropis is structurally intermediate between other members of the *phyllostomae* group and a complex of three genera—including *Paratrichobius, Neotrichobius,* and *Megistopoda*—which, like the *phyllostomae* group occur on bats of the subfamilies Stenoderminae and Sturnirinae. The male gonapophyses are intermediate as regards the insertion of the paired ventral setae. Sternum V is similar in all of the above flies, in shape and chaetotaxy; it has exceptionally long macrosetae along apical margin.

Genus **Anatrichobius** Wenzel, new genus

Type-species: *Anatrichobius scorzai* Wenzel, new species.

Closely related to *Joblingia,* with very similar head structure and like it, having the accessory setae of the male gonapophyses inserted anterior to the macrosetae. Differing from *Joblingia* in its much smaller size and relatively short legs and in the following characters: both the lateral and vertical membranous clefts of the thorax are open (longitudinal cleft closed and indicated by a dark suture in *Joblingia*) ; the median suture of the mesonotum does not extend beyond the transverse suture (to the scutellum in *Joblingia*) ; sternum V is present and divided into two sternites (absent in *Joblingia*) ; tergum VII absent or a single, median, very short, transverse, setose sclerite in the female (represented by a vertical, elongated, very feebly sclerotized, setose area with associatd spiracle on each side of hypopygium in *Joblingia*) ; female seventh sternum divided into two longitudinal sternites (a single median sclerite, though strongly emarginate anteriorly and posteriorly in *Joblingia*) ; finally, the thorax is very high and is dorsally strongly convex in *Joblingia,* whereas it is distinctly wider than high and only feebly convex above in *Anatrichobius.*

Anatrichobius is also superficially similar to *Aspidoptera* but differs in that it has elongate, foliaceous palpi rather than transverse nearly vertical ones; the anterior thoracic spiracles are very small and inconspicuous (relatively large and conspicuous in *Aspidoptera*) ; sternum V (male) is divided into two sclerites rather than undivided; and the accessory setae of the male gonapophyses are inserted anterior rather than posterior to the macrosetae.

DIAGNOSIS: Medium sized species with dorsum of body and legs clothed with long setae. *Head.*—Convex, oval, sides subparallel. Laterovertices and occipital plates differentiated, the laterovertices subquadrate. Eyes small, faceted. Palpi leaf-like, longer than broad. *Thorax.*—Short above, wider than long. Anterior margin of prescutum broadly emarginate, pronotum narrowly emarginate behind the head. Spiracles small.

inconspicuous. Median mesonotal suture not extending beyond the transverse suture. Scutum very short and wide. Scutellum small. Vertical longitudinal cleft extending nearly to mesocoxal cavity. Venter elongated, slightly longer than wide, sternopleura only slightly longer than pleurotrochantines. *Wings.*—Brachypterous, venation essentially complete but variable. *Legs.*—Moderately developed, the middle legs shortest, the hind legs longest, metafemora about half again as long as mesofemora. Hind coxae large. Tarsi short; tarsomeres 1–4 strongly compressed antero-posteriorly, 5 large, conspicuous.

Abdomen.—Dorsal connexivum densely clothed with long setae. *Female:* Tergum VII very short and wide, or absent. Supra-anal plate cordiform, pointed at apex. Cerci articulated to supra-anal plate by a short process, united ventrally with the ventral arc. Seventh sternites elongated, their inner apical margins flange-like and strongly sclerotized, articulated with the median lobe of the ventral arc as well as with a pregenital sclerite (VIII ?). Sternum IX visible externally. *Male:* Hypopygium broadly conical. Sternum V divided into two transverse, oval, feebly sclerotized sternites. Sternum VI absent. Gonapophyses blade-like, the accessory setae situated anterior to the macrosetae.

Anatrichobius scorzai Wenzel, new species. Figures 76–78.

DESCRIPTION: Chaetotaxy as illustrated. Micropile present on upper surface of palpi, head, mesonotum (except a broad median area), and abdomen including setose area of sternum II, and upper setose areas (at least apically) of femora. Intervals between femoral and some coxal setae may appear scabrous in slide preparations. *Head.*—Broadly pyriform, the dorsum convex. Laterovertices with about 20 setae, most of the anterior setae shorter; occipital lobes with about 25–30 setae. Eyes small, horizontal, with seven or eight small facets. Genae and postgenae densely setose, the dorsal and apical setae longest. *Thorax.*—Median suture usually united with the transverse suture, sometimes extending only a little beyond middle; transverse suture usually complete, occasionally poorly defined at middle. Prescutum with 38–40 setae on each side of median suture. Scutum with about 24–26 setae. Scutellum with four scutellar macrosetae in a transverse row and two additional ones at middle of apical margin. Mesepisterna clothed with dense long setae above. *Wings.*—Brachypterous, as shown in fig. 76, venation variable. *Legs.*—Hind tibiae with denser short setae along inner apical face, but not forming a dense patch. Last tarsomere about as long as 1–4 combined. *Abdomen.*—Connexivum in both sexes dorsally clothed with long setae; lateral connexival setae shorter, the ventral setae minute. *Female:* Lateral lobes of tergum I+II longer than in the male, the posterior part of the lobe (viewed from the side) bare; the dorsal margin (near midlength) with a cluster of 12–14 longer setae which are continued anteriorly and across middle of margin by a row of short setae. Dorsal connexivum clothed with long setae, these more prominent laterally; setae of lateral connexivum shorter, those of venter very short, except for segmentally arranged pairs of long setae. Tergum VII curved posteriorly on each side, with from 12–20 setae, some of these often displaced and situated on connexivum. Supra-anal plate with from 10–12 setae. Seventh sternites with numerous macrosetae apically, shorter setae basally. *Male:* Lateral lobe of tergum I+II posteriorly with numerous discal and marginal setae, these shorter ventrally. Dorsal connexivum with a mixture of long and shorter setae, the long ones shorter than in female. Setae of sternum V similar to those of ventral connexivum, the anterior ones a little shorter. Hypopygium with numerous long macrosetae dorsally and short setae ventrally. Gonapophyses (fig. 78C) nearly alike.

Measurements:	BL	TL
Male	2.42–2.64	0.52–0.55
Female	2.99–3.30	0.60–0.77

TYPE MATERIAL: Holotype male (host no. 7459) and allotype female (host no. 7468), both in alcohol, from *Myotis* sp., Cueva Lara (Chiriquí), 5600 feet elevation, 3 May 1961, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

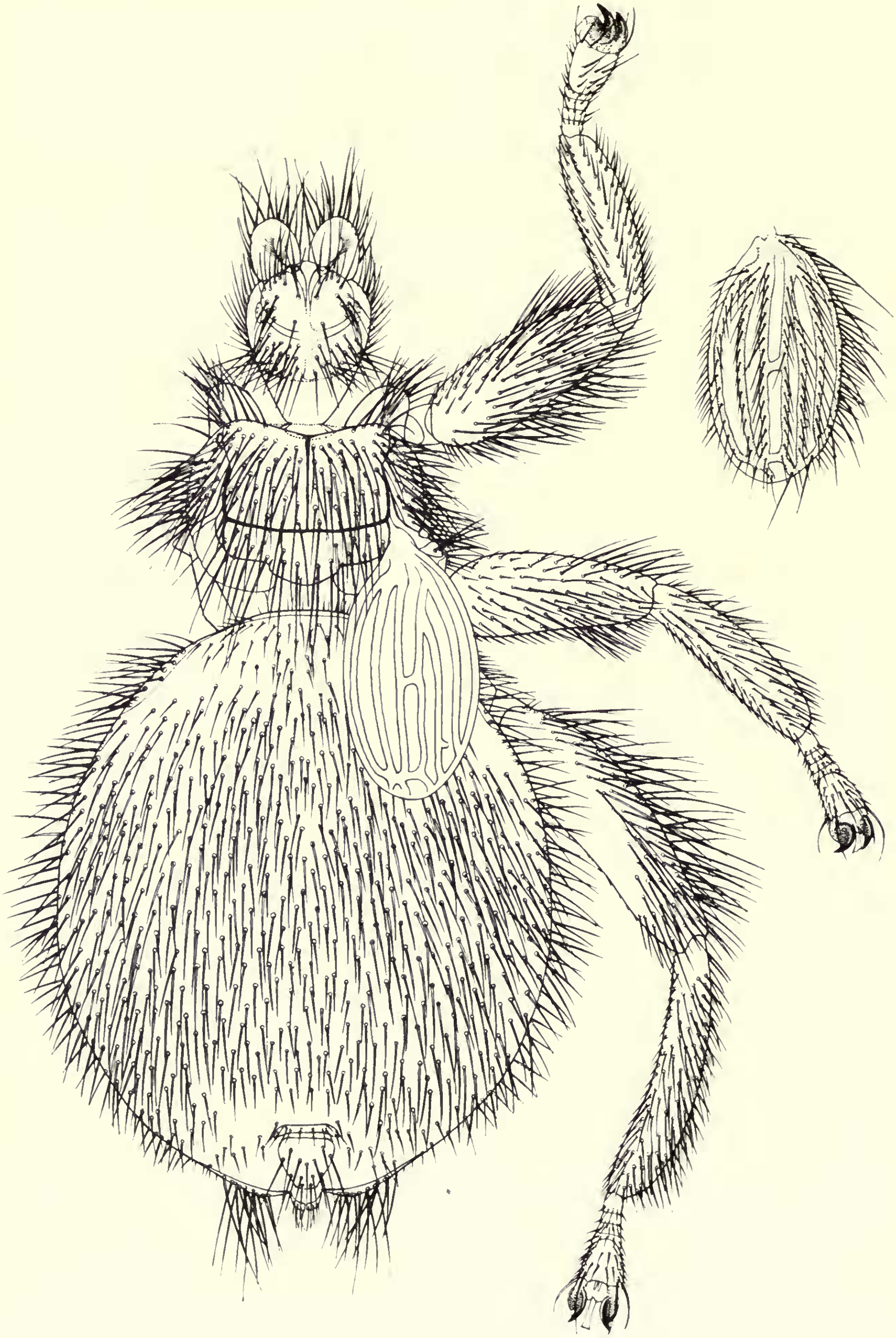

Fig. 76. *Anatrichobius scorzai*, n. gen., n. sp. Female paratype, dorsal view, and right wing. Made from specimens taken from a mixed collection of *Myotis n. nigricans* and *M. chiloensis*, at Cueva Lara, Casa Tilley, Cerro Punta (Chiriquí).

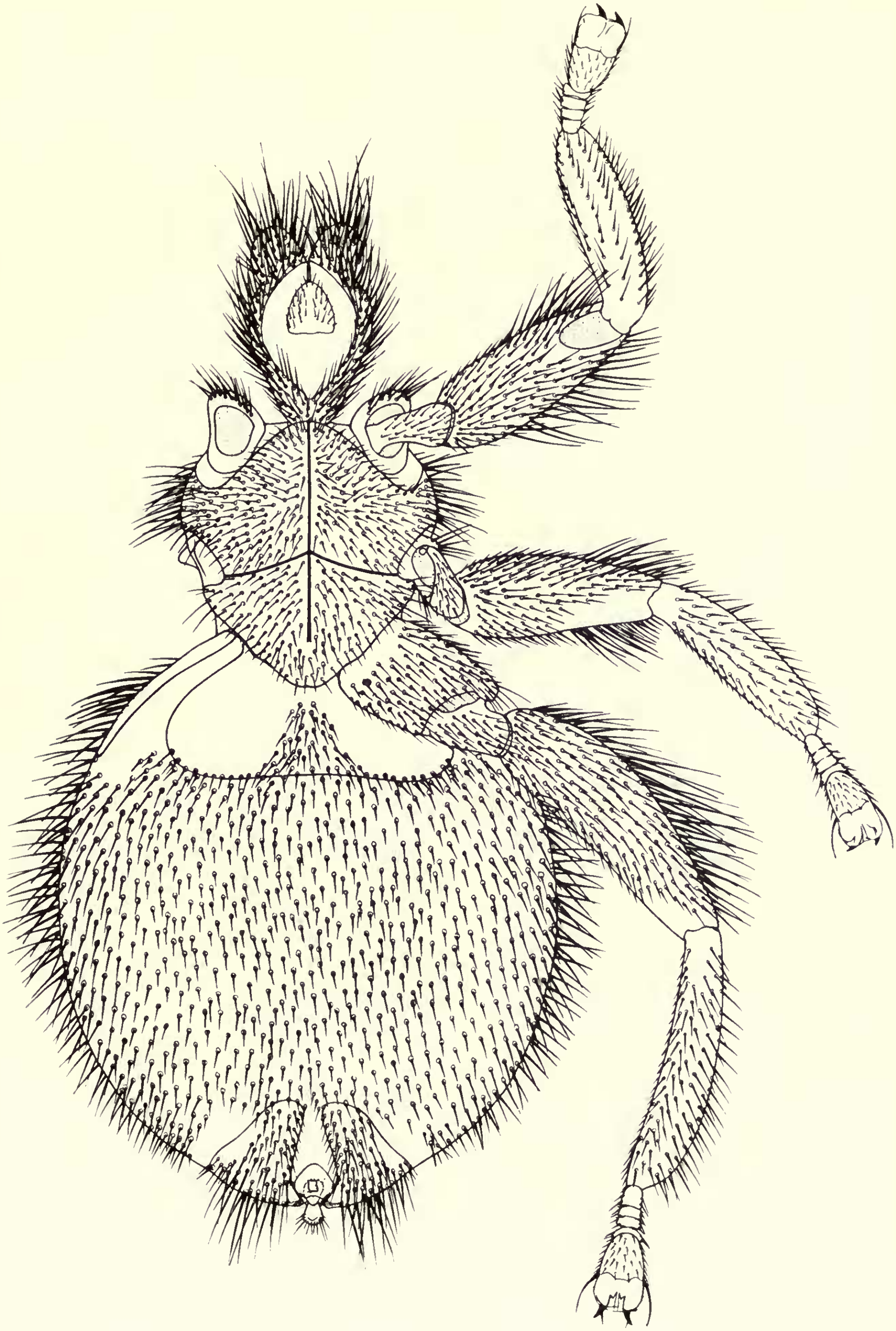

Fig. 77. *Anatrichobius scorzai*, n. gen., n. sp., female. Ventral view. From same specimens as fig. 76.

Paratypes.—From *Myotis* sp.: 1, same data as holotype; 1, Casa Lewis, Cerro Punta (Chiriquí), 5600 feet elevation, 4 May 1960; 1, same data but 12 March 1962. From *Myotis nigricans:* 4, Cave, Finca Lara, (Chiriquí), over 5800 feet elevation, 5 May 1961; 3, Lara's Cave, Cerro Punta (Chiriquí), 6 March 1962; 1, Cerro Hoya (Los Santos), 21 February 1962. From *Myotis chiloensis:* 1, Lara's Cave, Cerro Punta (Chiriquí), 5600 feet elevation, 6 March 1962. From a mixed collection *Myotis nigricans* and *M. chiloensis:* 47 (3 lots), Lara's Cave, Cerro Punta (Chiriquí), 6 March 1962. From *bat guano:* 1, Lara's Cave, Cerro Punta (Chiriquí), 6 March 1962. *Without host:* 2, Cerro Azul (Panamá), elevation about 2000 feet, 25 and 27 January 1958.

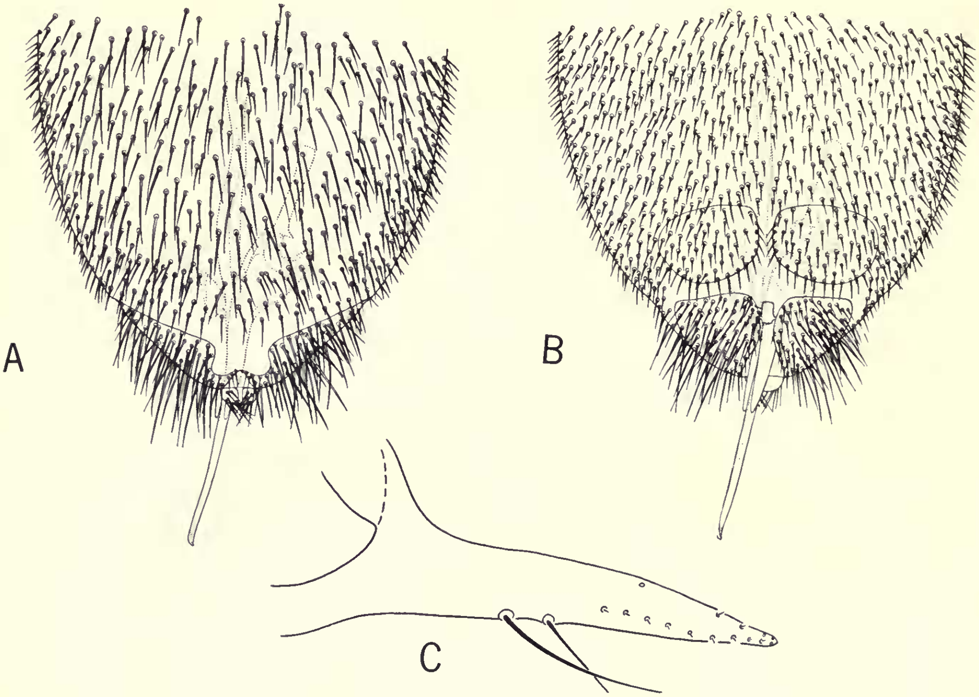

Fig. 78. *Anatrichobius scorzai* n. gen., n. sp., male abdomen. A, dorsal, and B, ventral views. C, left gonapophysis, lateral view. Data as for female (fig. 76).

From *Myotis n. nigricans:* 30, from a room of old building of Biological Station, Rancho Grande (Aragua), VENEZUELA, 7 July to 30 September 1962, C. and A. Machado, R. Antequera and M. Ramirez [FCUCV]. From *Myotis nigricans:* 3, San Antonio, San Agustín (Huila), COLOMBIA, 2350 meters elevation, 18 October 1951, P. Hershkovitz, CNHM Colombia Zoological Expedition (1948–52). From *Myotis chiloensis oxyotis:* 3, Hacienda Cadena, Marcapata (Cuzco), PERU, 1000 meters elevation, 19 February 1949, Celestino Kalinowski. From *Lonchophylla robusta* (!): 1, Rancho

Grande (Aragua) VENEZUELA, Wm. T. Beebe [MCZ]. Paratypes to be deposited in the collections of Chicago Natural History Museum; the United States National Museum; Museum of Comparative Zoology at Harvard University; the Gorgas Memorial Laboratory, at Panamá (Panamá); the Environmental Health Branch (United States Army) at Corozal (Canal Zone); and the Universidad Central de Venezuela, Caracas.

REMARKS: *Anatrichobius scorzai* is named in honor of Dr. José Vicente Scorza, Head of the Department of Parasitology, Escuela de Biología, Faculdad de Ciencias, Universidad Central de Venezuela. The puparium of this species will be described later by Machado-Allison. The female specimen illustrated (figs. 76, 77) was distorted by pressure on the slide. In gravid females, the abdomen is never quite as broad and rounded as shown. Tergum VII of the specimen illustrated has fewer setae than is typical.

An undescribed species of *Anatrichobius* is known to us from Peru and Brazil. It differs strikingly from *scorzai* in that tergum VII is absent in the female and the chaetotaxy of the supra-anal plate is reduced to from four to six setae.

Genus **Joblingia** Dybas and Wenzel

Joblingia Dybas and Wenzel, 1947, Fieldiana, Zool., **31**: 149. Jobling, 1949, Parasitology, **39**: 322 (keyed).

Undescribed genus, Bequaert, 1942, Bol. Ent. Venez., **1**: 86 (notes).

Type-species: *Joblingia schmidti* Dybas and Wenzel, 1947.

Until the Panamanian collections were obtained, the type-species of *Joblingia* was known only from the unique female holotype. Both males and females were collected in Panama, and it is now possible to give the characters of the male and to correct several errors in the original diagnosis of the genus and description of the species. The following may be added to the diagnosis of the genus.

Head.—Laterovertices and occipital plates differentiated, but weakly sclerotized, connected by a narrow sclerotized strip along inner margins. Eyes small, vertical. *Thorax.*—Height greater than dorsal width. Mesonotum strongly convex; median suture extending posteriorly to scutellum. Longitudinal membranous cleft closed, the line of fusion marked by a dark pigmented suture. Vertical membranous cleft reaching about halfway to coxal cavity. *Abdomen.—Female:* Seventh tergum represented by a vertical elongate setose area (which encloses the spiracle VII) on each side of the hypopygium. Sternum VII a single median plate which is emarginate along mid-line both anteriorly and posteriorly. Cerci united with the ventral arc, the latter not united with the supra-anal plate. Both dorsal and ventral anal sclerites present. *Male:* Sterna V and VI absent, VII and VIII fused with IX. Hypopygium broadly conical. Gonapophyses with accessory setae inserted anterior to the macrosetae.

Joblingia schmidti Dybas and Wenzel. Figures 79, 80.

Joblingia schmidti Dybas and Wenzel, 1947, Fieldiana, Zool., **31**: 152, figs. 25–27—Guatemala: Chocoyos (Chimaltenango), from *Myotis n. nigricans* (Chicago Natural History Museum). Jobling, 1949, Parasitology, **39**: 316 ff, fig. 3G, H.

The following characters are added to the original description:

Legs.—Proportionally shorter in males than in females. *Abdomen.—Female:* Tergum I+II with dorsal and ventral groups of short bristles anteriorly and numerous very

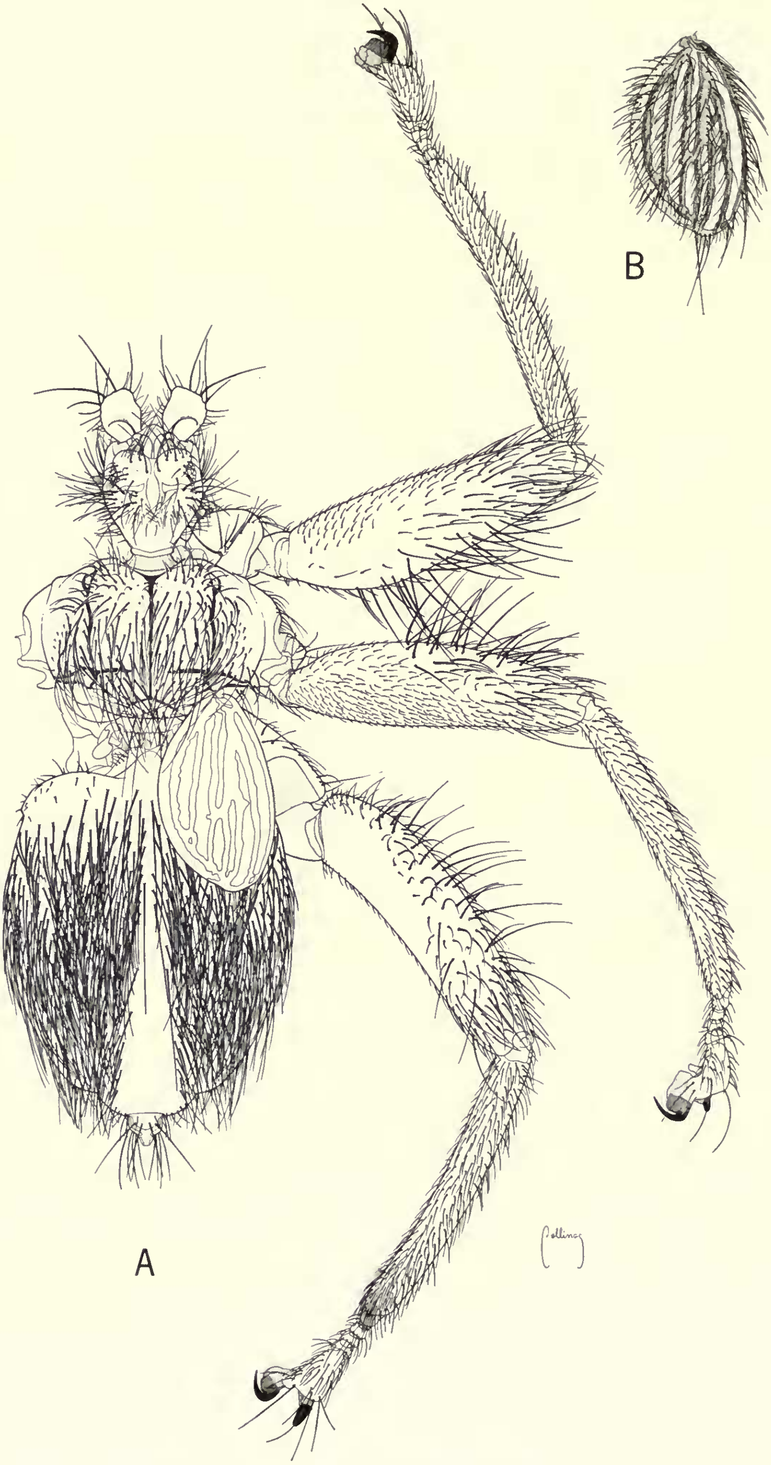

Fig. 79. *Joblingia schmidti* Dybas and Wenzel, female. Dorsal view. From Dybas and Wenzel (1947), with corrections.

short rather stout bristles on posterior margin of lateral lobe. Tergum VII represented on each side lateral to the terminal cone by a vertical elongate area (with shorter setae than connexivum) which encloses seventh spiracle. Seventh sternum not divided, though it is emarginate anteriorly and posteriorly and the setae are arranged as on two sternites, with a median smooth area between two extensive groups. *Male:* Lateral lobes of tergum I+II densely clothed with long and short bristles, these shorter along dorsal and ventral margins. Connexivum between lateral lobes with dense setae of moderate length, elsewhere (dorsally and ventrally) except along mid-line near apex, with minute setae borne on small plaques. Hypopygium broadly conical, densely clothed with setae, these very long macrosetae posteriorly, shorter anteriorly and ventrally. Sternum II less strongly emarginate at middle than in female. Gonapophyses as in fig. 80.

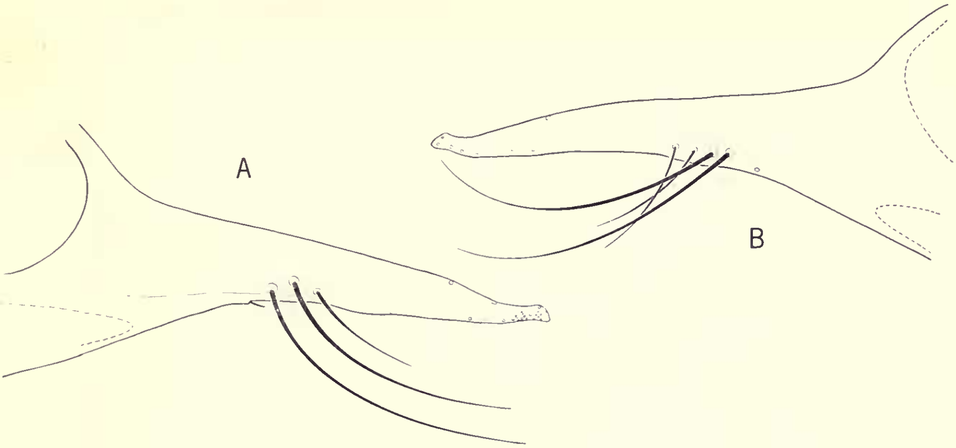

Fig. 80. *Joblingia schmidti* Dybas and Wenzel. A, left, and B, right male gonapophyses, lateral view. From *Myotis nigricans* (no. 7466), Cueva Lara, Casa Tilley, Cerro Punta (Chiriquí).

Measurements:	BL	TL
Male	3.96–4.06	1.04–1.07
Female	4.97–5.50	1.03–1.16

MATERIAL EXAMINED: 31 specimens (10 lots), all from Cueva Lara, Casa Tilley, Cerro Punta (Chiriquí), elevation 5600 feet.—From *Myotis nigricans:* 10 (4 bats), 3 May 1961. From *Myotis* sp.: 1, 5 May 1961. From *Myotis chiloensis:* 1, 3 May 1961. From mixed collection of *M. nigricans* and *M. chiloensis:* 7 (3 lots), 6 March 1962. From *bat guano:* 8, 6 March 1962.

REMARKS: The original figures of Dybas and Wenzel (op. cit.), showed the laterovertices and occipital lobes as poorly defined areas. These were poorly pigmented and defined in the female holotype. The figure is reproduced here (fig. 79) with corrections.

Trichobioides Wenzel, new genus

Type-species: *Trichobius perspicillatus* Pessôa and Galvão, 1937.

Trichobioides closely resembles *Trichobius,* but differs as follows: palpi without setae on ventral surface (present in *Trichobius*); upper surface of palpi with a longitudinal tuberculate ridge near mesal margin (absent in *Trichobius*); costa and R_1 united opposite third crossvein (beyond level of third crossvein in *Trichobius*); palpi and theca (when retracted) coapted with apices of genae to form a vertical shield across the front of the head (not so in *Trichobius*); laterovertices with an oblique dark line which divides them into two parts (absent in *Trichobius*); and the female seventh sternites and the connexivum forming prominent apical lobes (not so in *Trichobius*).

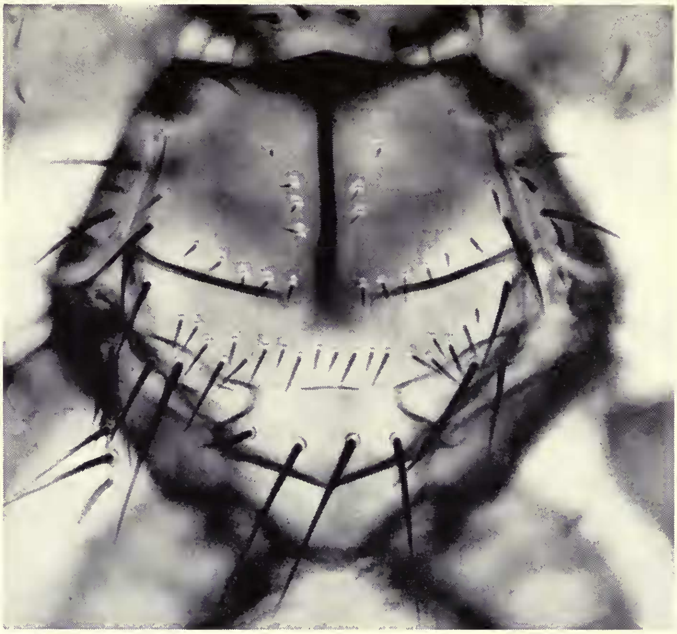

Fig. 81. *Trichobioides perspicillatus* (Pessôa and Galvão). Thorax, dorsal view, of male from *Phyllostomus d. discolor* (TVL nos. 1142–46), Santa Cruz, TRINIDAD.

DIAGNOSIS: *Head.*—Co-apted with and nearly as broad as the bisinuate anterior thoracic margin. Laterovertices and occipital lobes well defined, the laterovertices divided into two parts by an oblique, dark line (most conspicuous in alcohol specimens). Postvertex sclerotized, without setae, continuous with the occipital lobes. Palpi broad, with few setae, these restricted to margins; ventral surface bare, upper surface microsetose; upper surface with a sharp longitudinal bituberculate ridge near mesal margin, each tubercle bearing a short seta. Eyes conspicuously separated from lateral margins of head. *Thorax.*—Broad, narrowing anteriorly; prescutum very long, more than twice as long as scutum. *Wings.*—Relatively short; setae of veins conspicuous; costa and R_1 with macrosetae from base to juncture, opposite the third crossvein. *Legs.*—Short, middle and hind legs subequal, the hindlegs slightly longer; femora stout, with both macrosetae and short setae; tibiae with very short, fine setae only; tarsi short.

Abdomen.—Sternum I+II broad, as wide as abdomen. *Female:* Tergum VII very short. Cerci not united with the heavily sclerotized ventral arc. Seventh sternites long, produced apically as subconical lobes, which extend as far as or beyond apex of proctiger. *Male:* Hypopygium prominent, broadly conical. Sternum V short and broad, not divided. Sternum VI present as a very fine thread-like band. Gonapophyses with paired setae inserted on lateral face, the accessory seta below or slightly posterior to macroseta.

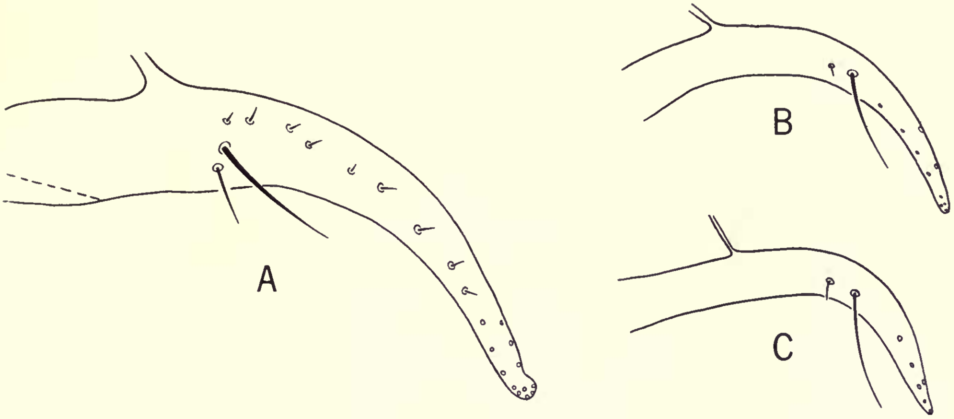

Fig. 82. Left male gonapophysis, lateral view. A, *Trichobioides perspicillatus* (Pessôa and Galvão), from *Phyllostomus d. discolor* (no. 6348), Río Mandinga, (San Blas). B, *Mastoptera minuta* (Costa Lima), from *Tonatia silvicola* (no. 9477) Guánico (Los Santos). C, *Mastoptera guimaraesi*, new species from *Phyllostomus h. panamensis* (no. 4644), Chepo Road (Panamá).

Trichobioides perspicillatus (Pessôa and Galvão), *new combination.* Figures 81, 82A.

Trichobius perspicillatus Pessôa and Galvão, 1937, Folia Clin. Biol., São Paulo, 9: 1, figs. 1–3—"Bahia," from undet. host and *Hemiderma perspicillatum* (Laboratorio de Parasitologia, Faculdade de Medicina, Universidade de São Paulo). Guimarães, 1938, Rev. Mus. Paulista, 23: 655 (notes), 662 (keyed), fig. 4. Jobling, 1938, Parasitology, 30: 386, fig. 14A; 1949, ibidem, 39: 316 ff. (hosts), 326.

This remarkable species is easily recognized by the very distinctive mesonotal chaetotaxy (fig. 81). The female is also distinctive in the lobes formed by the seventh sternites.

Measurements:	BL	TL	WL	WW
Male	1.00–1.54	0.49–0.51	0.93–1.10	0.49–0.55
Female	1.59–1.84	0.53–0.58	1.10–1.15	0.55–0.60

PANAMANIAN MATERIAL EXAMINED: 12 specimens in (5 lots) from 6 bats. From *Phyllostomus d. discolor:* 8 (2 bats), Río Mandinga (San Blas), 18 and 29 May 1957, E. Méndez [GML]; 1 (probably this host), Cerro Azul (Panamá), about 2000 feet elevation, 25 January 1958, E. Méndez [GML]. From *Sturnira lilium parvidens:* 1, Río Tuira (Darién), 25 February 1958,

P. Galindo [GML]. From *Desmodus rotundus murinus:* 2 (2 bats), Guánico (Los Santos), 26 January 1962.

OTHER MATERIAL EXAMINED: More than 100 specimens from GUATEMALA, EL SALVADOR, COSTA RICA, COLOMBIA, VENEZUELA, SURINAM, TRINIDAD, and PERU. Nearly all of these are from *Phyllostomus d. discolor* and *P. d. verrucosus,* except one record from *Phyllostomus elongatus* (COLOMBIA) and one from a bat doubtfully identified in the field as *Phyllostomus h. hastatus* (SURINAM).

REMARKS: The primary host of this fly appears to be *Phyllostomus discolor,* though it probably occurs on other species of *Phyllostomus.* The Panamanian records from *Sturnira* and *Desmodus* may represent transitory associations or errors in field labeling. As noted elsewhere, a number of the flies collected in Los Santos were incorrectly associated with the hosts.

Mastoptera Wenzel, new genus

Type-species: *Aspidoptera minuta* Costa Lima, 1921.

The species of *Mastoptera* superficially resemble those of the genus *Aspidoptera* but differ in having mouthparts and genae co-apted (in repose) becoming a frontal shield, as in *Trichobioides;* the posterior extension of the median mesonotal suture nearly to the scutellum; the closure of the vertical membranous cleft without evident suture; the reduced wing venation and the apical digitiform process at apex of the wing; the presence of flanges on the ventral arc (female) and numerous other characters. Actually, *Mastoptera* is closely related to the macropterous *Trichobioides* and possesses many characters of that genus, including the co-apted mouthparts; the palpal flange; the posteriorly strongly widened thorax; similar male gonapophyses (though the paired ventral setae are inserted more distally); the broadly conical hypopygium, the presence of flanges on the ventral arc of the female, and the conspicuously long macrosetae of the apex of the abdomen. Easily separated from all other genera by the extraordinarily widely separated hind coxae, and by the digitiform process at the apex of the wings.

DIAGNOSIS: Minute dorso-ventrally somewhat flattened brachypterous species, 0.73–1.29 mm. long. *Head.*—Sides of head converging posteriorly, the posterior margin and anterior edge of the prescutum co-apted. Laterovertices and occipital plates distinct. Theca short, wider than long, vertical when retracted and co-apted with palpi and genae to form a frontal "shield." Palpi vertical, subtriangular, apices broadly truncate; ventral surface with setae on basal half only; upper surface microsetose on distal half, with a longitudinal submarginal flange near inner edge. Eyes minute, with one or two facets.

Thorax.—Anterior margin of prescutum strongly emarginate, on a little more than middle third of width. Median suture extending posteriorly to or near the scutellum; transverse suture absent or indistinct, represented by pigmentation only, though sometimes distinct at middle. Posterior margin of scutellum emarginate. Longitudinal membranous cleft open, short; vertical membranous cleft closed, without evidence of a suture. Spiracles small, rosette-like. Mesepisterna broad and setigerous dorsally, widest posteriorly. *Wings* (fig. 83C).—Brachypterous, venation indistinct; each wing with a digitiform process (rarely two ?) at apex. Anterior margin of sternopleura truncate, feebly projecting. Posterior margin of pleurotrochantines nearly straight, very broad, approximately as wide as hind femora are long. *Legs.*—Short, subequal. Hind coxae widely separated. Femora with long sparse setae antero-dorsally, in addition to short ones on antero-ventral or posterior faces. Tibiae with very short setae arranged in rows, tibiae and tarsi subequal. Tarsomeres 1–4 progressively shorter, 4 rather strongly compressed antero-posteriorly; sides of last tarsomere subparallel.

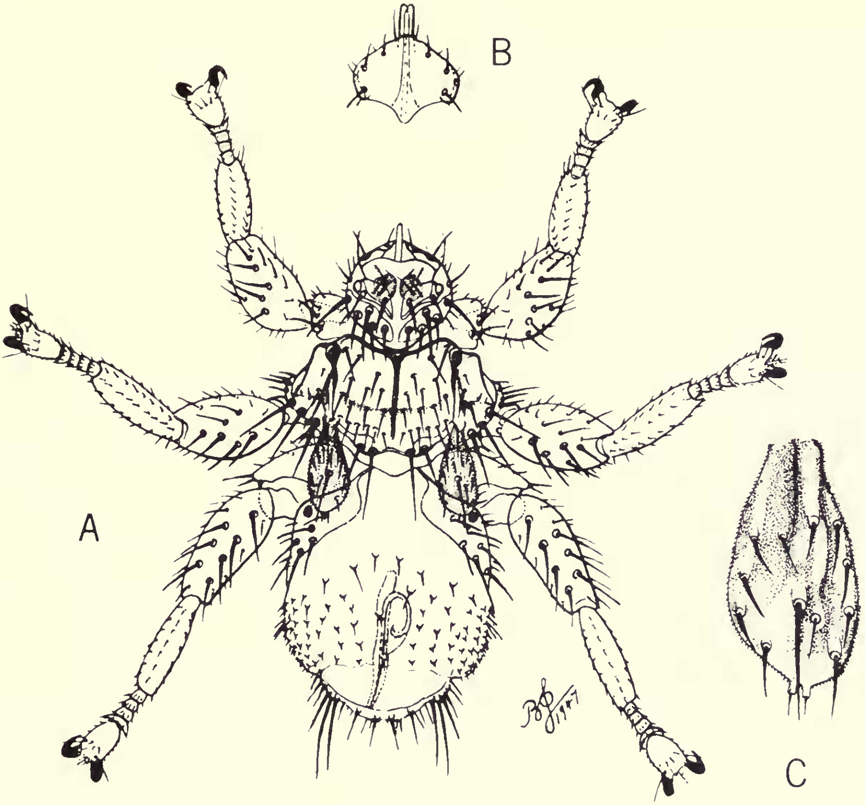

Fig. 83. *Mastoptera guimaraesi*, new species. A, dorsal view, male. B, labium. C, wing. From Jobling (1957, as *Aspidoptera minuta*).

Abdomen.—Tergum I+II membranous along mid-line, nearly to base; lateral lobes conspicuous, usually about half as long as abdomen and bearing conspicuous macrosetae. Connexival setae borne on conspicuous plaques. *Female:* Tergum VII and supra-anal plate together forming a broad terminal cone; tergum VII feebly sclerotized, but apparently subquadrate and about twice as broad as long; supra-anal plate short and transverse; seventh sternites small, slightly produced posteriorly as lobes. Cerci free, not united with the ventral arc, the latter with flange-like projections. *Male:* Sternum V present, short and broad. Sternum VI absent. Hypopygium very broadly conical. Gonapophyses curved; paired setae inserted near mid-length, the macroseta anterior to the accessory seta; gonapophyseal apodeme trough-like. Adeagus flagelliform.

At present we are able to distinguish two species of this genus: *M. minuta* (Costa Lima) from bats of the genus *Tonatia* and from *Phyllos-*

tomus hastatus, and *M. guimaraesi* n.sp. from *Phyllostomus hastatus panamensis.* It is possible that careful study of adequate material may show that each species of *Tonatia* harbors a separate species of *Mastoptera,* as is true for the streblids of the genera *Pseudostrebla, Trichobius,* and *Strebla.*

KEY TO SPECIES OF *MASTOPTERA*

MALES

Tergum I+II with seven to nine conspicuous, long to moderately long bristles, and, along lateral margin, five to seven short ones; longest seta followed distally by one long bristle, lateral to which is a very short bristle (fig. 84A). Gonapophyses more strongly curved, with dorsal margin feebly sinuate before apex (fig. 82C). Host: *Phyllostomus hastatus panamensis* .... *guimaraesi* n.sp.

Tergum I+II with nine to twelve conspicuous bristles and, along lateral margin, two or three very short ones; longest seta followed distally by two shorter but conspicuous, long bristles (fig. 85B). Gonapophyses with dorsal margin evenly curved before apex (fig. 82B). Hosts: *Tonatia* spp., *Phyllostomus hastatus* (? subsp. *hastatus*) .... *minuta* (Costa Lima)

FEMALES

Lateral lobes of tergum I+II very long, nearly as long as hind coxa and femur combined. Dorsal abdominal connexivum with from one to three setae which are conspicuously longer and coarser than the others, on each side medial and slightly posterior to apices of lateral lobes of tergum I+II (fig. 84A). Sternum II nearly as long as venter of thorax; seventh sternites with setae along inner and distal margins only, elsewhere microsetose .... *guimaraesi* n.sp.

Lateral lobes of tergum I+II only slightly longer than hind femora. Dorsal abdominal connexivum lacking conspicuously coarser and longer setae medial to apices of lateral lobes of tergum I+II. Sternum II only a little more than half as long as venter of thorax; seventh sternites with setae throughout, in addition to microsetae .... *minuta* (Costa Lima)

Mastoptera guimaraesi Wenzel, new species. Figures 82C, 83, 84.

Aspidoptera minuta (not Costa Lima, 1924), Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 417; 1942, Bol. Ent. Venez., 1: 88 (records). Jobling, 1949, Proc. Roy. Ent. Soc. Lond., (B), 18: 142 (part.), fig. 4; 1949, Parasitology, 39: 316–317 (part.), fig. II.

Very similar to *M. minuta* (Costa Lima), but differing by the characters given in the key (and noted below). As indicated above, the description and figure given by Jobling (1949) apply to this species, except for the record from *Tonatia amblyotis* (= *T. silvicola*). In addition to characters given by Jobling, the following diagnostic features may be noted.

DESCRIPTION: *Head.*—Eyes with two indistinct facets (one in *minuta*). *Abdomen: Male.*—Tergum I+II with seven to nine conspicuous long bristles and five to seven short ones along the lateral margin; longest macroseta followed distally by one shorter but long, conspicuous seta lateral to which may be a short seta. Gonapophyses with upper margin slightly sinuate before apex (fig. 82C). *Female:* Tergum I+II very long, nearly as long as hind femur and coxa combined. Connexivum dorsally with from one to three coarse bristles longer than the others, medial and slightly apical to apex of lateral lobes of tergum I+II. Sternum II nearly as long as underside of thorax. Seventh sternites with setae restricted to distal and inner margins, the rest of the surface microsetose only.

Measurements:	BL	TL
Male	1.00–1.10	0.27–0.29
Female	1.23–1.29	0.29–0.33

TYPE MATERIAL: Holotype male (slide) from *Phyllostomus hastatus* *panamensis* (host no. 4644), hollow tree, Chepo Road (Panamá), 8 October 1959, C. M. Keenan and V. J. Tipton; allotype female (slide), same data but host no. 4641; both in the collection of Chicago Natural History Museum.

Paratypes.—From *Phyllostomus hastatus panamensis,* 284 in 30 lots from 68 bats, as follows: 1, Madden Dam (Canal Zone), 31 August 1959; 75 (19 bats), Fort Sherman (Canal Zone), 4 and 6 April 1960; 2, Fort Clayton (Canal Zone), 20 June 1960; 2, Farfan (Canal Zone), 19 December 1915, T. Hallinan [AMNH]; 161 (18 bats), same data as the holotype; 2 (2 bats), Chilibrillo Caves (Panamá), 28 October 1959, and 12 (20 bats), same locality, 17 July 1959; 1, same locality, 28 May 1931, L. H. Dunn no. 22 [AMNH]; 2, same locality, without data [MCZ]; 2, Tapia (Panamá), 25 July 1923, J. P. Chapin [MCZ]; 1, "Panama," [USNM]; 5 (1 bat), Almirante (Bocas del Toro). From *Phyllostomus* sp.: 6 (2 bats), Camp Piña (Canal Zone), 26 October 1960; 1, Guánico (Los Santos), 22 January 1962. Paratypes to be deposited in the collections listed on p. 410.

OTHER MATERIAL EXAMINED: PANAMA.—From *Carollia p. azteca:* 1, culvert, Chepo Road (Panamá). *Without host:* 1, Chilibrillo Caves (Panamá), 17 July 1959; 2, same locality [MCZ]; 1 (slide), "Canal Zone, Busck, April 30" [USNM, det. as *A. minuta* by Q. C. Kessel]. COLOMBIA.—Several lots taken from *Phyllostomus hastatus* in the Departments of Huila and Bolivar, by P. Hershkovitz, CNHM Colombian Zoological Expedition 1948–52.

REMARKS: Jobling indicated that this species had a single eye facet, but our material indicates that there are two indistinct facets. In *minuta,* there appears to be only one. Jobling's figure (see fig. 83) is of a specimen from *Phyllostomus h. panamensis* taken at Chilibrillo Caves (Panamá). It is somewhat inaccurate or atypical in several respects. The anterior margin of the prescutum is not broadly emarginate, as shown, but straight on each side and emarginate at middle only. The wing is shown with two setigerous digitiform processes at apex. We have not seen more than one such process in the specimens examined by us.

This species is named for Dr. Lindolpho Guimarães of the Departamento de Zoologia, Secretaria da Agricultura, São Paulo, Brazil, in recognition of his many valuable contributions to our knowledge of ectoparasites, and especially his outstanding studies on the New World batflies, both Streblidae and Nycteribiidae.

Mastoptera minuta (Costa Lima), *new combination.* Figures 82B, 85.

Aspidoptera minuta Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, 5: 21–22 (descr., keyed), 29 (cat.), pl. 2, fig. 2—Brazil: Matto-Grosso, from *Tonatia amblyotes* [*sic!*] (? Museu Nacional do Rio de Janeiro). Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 26, pl. 2, fig. 13 (? part.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 658. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479 (fig., Streblidae II.—4). Jobling, 1949, Parasitology, 39: 316–317 (part); 1949, Proc. Roy. Ent. Soc. Lond., (B), 18: 136 (keyed), 142 (part., record from *Tonatia* only).

This species may be separated from *guimaraesi* by the characters given

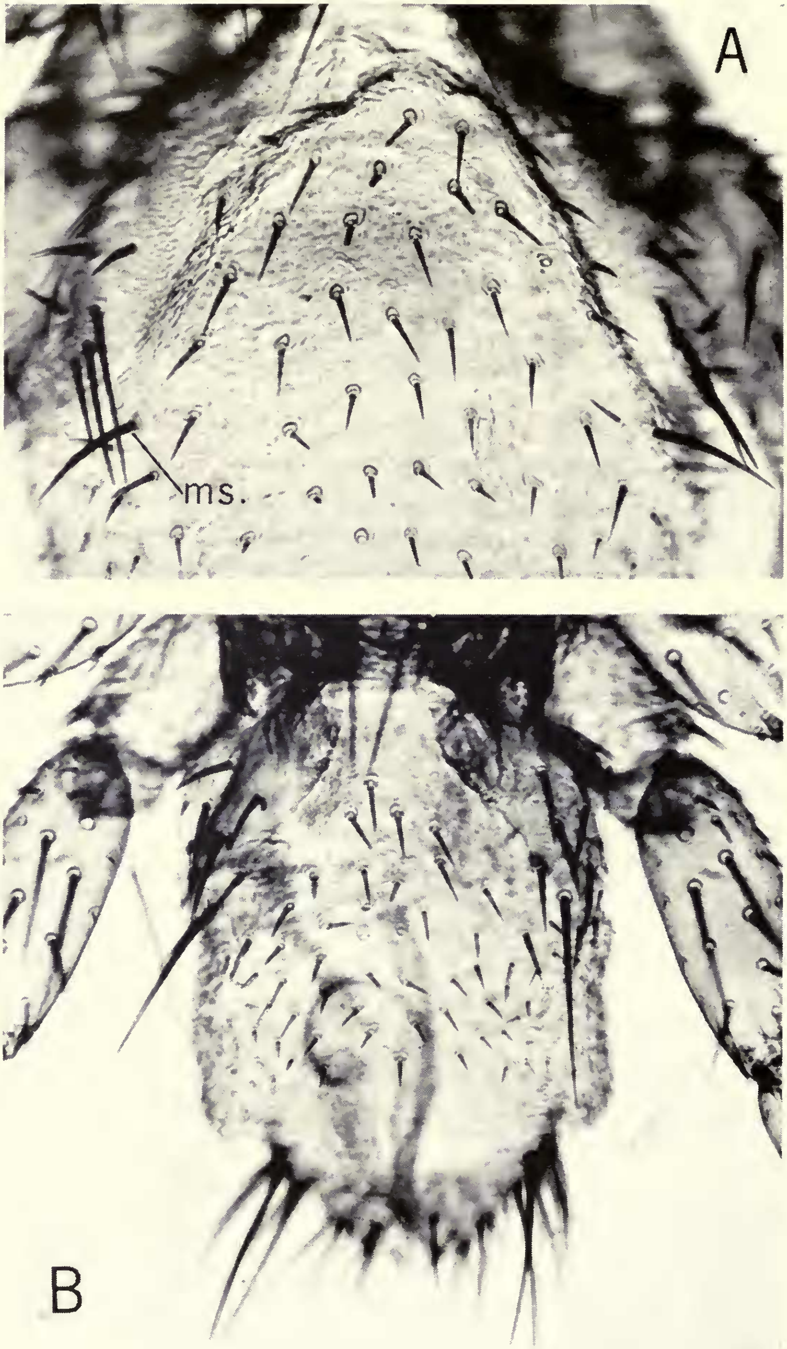

Fig. 84. *Mastoptera guimaraesi*, new species, base of abdomen, dorsal view. A, male (host no. 4644) and B, female (host no. 4641) paratypes from *Phyllostomus h. panamensis*, Chepo Road (Panamá). *ms*=dorsal connexival macroseta.

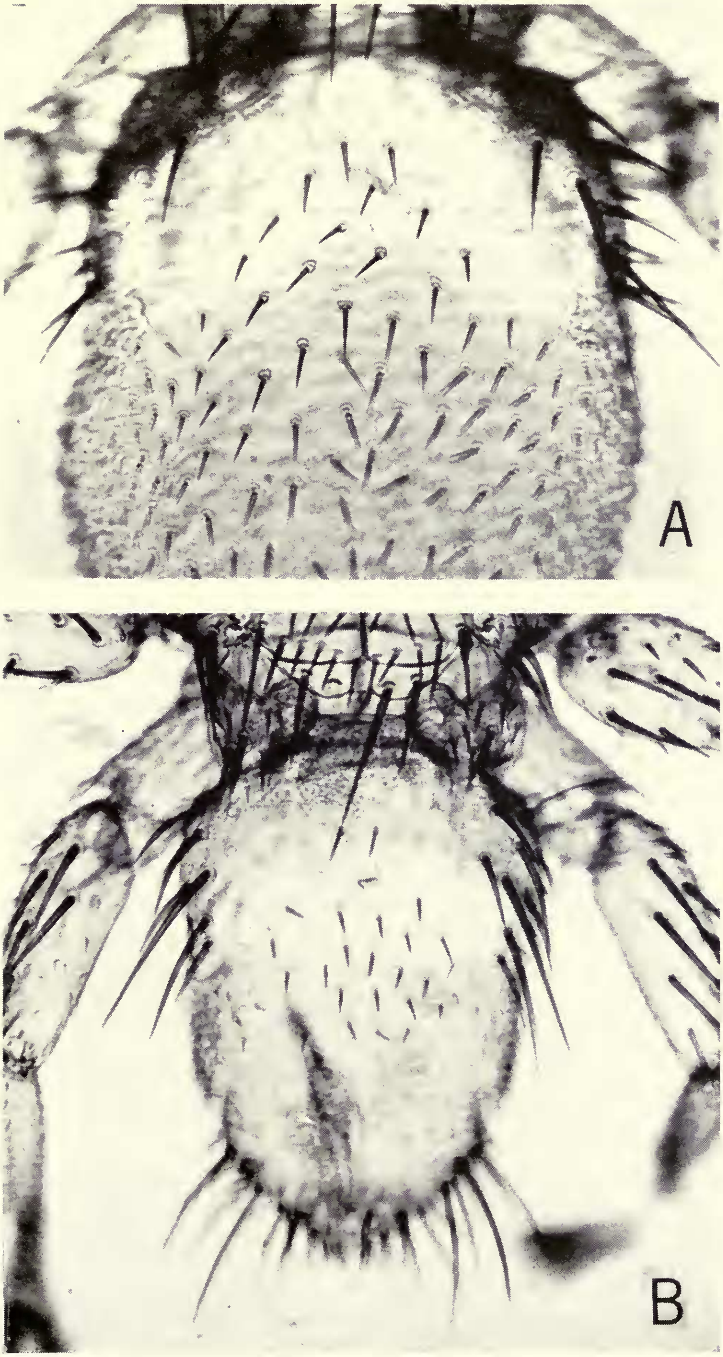

Fig. 85. *Mastoptera minuta* (Costa Lima). A, female, base of abdomen, dorsal view, paratype from *Tonatia silvicola* (no. 11698) Armila (San Blas). B, abdomen, male, dorsal view, paratype from *T. silvicola* (no. 9477), Guánico (Los Santos).

in the key. As can be seen from the following measurements, it is distinctly smaller than that species.

Measurements:	BL	TL
Male	0.73–0.96	0.19–0.30
Female	0.83–1.06	0.24–0.29

PANAMANIAN MATERIAL EXAMINED: 58 specimens (21 lots from 21 bats). From *Tonatia minuta,* 22 (6 bats) as follows: 3, Fort Sherman (Canal Zone), 2 December 1959; 2, Almirante (Bocas del Toro), 26 February 1960; 12 (2 bats), Sibube (Bocas del Toro), 17 and 24 January 1963, C. O. Handley, Jr.; 1, Las Palmitas (Los Santos), 24 January 1962; 5 (2 bats), Cerro Hoya (Los Santos), 24 January and 26 February 1962. From *Tonatia silvicola,* 35 (14 bats) as follows: 2, Sibube (Bocas del Toro), 22 January 1963, C. O. Handley, Jr.; 11 (5 bats), Guánico (Los Santos), 27 January to 1 March 1962; 21 (6 bats), Armila (San Blas), 1 to 29 March 1963, C. O. Handley, Jr. and F. M. Greenwell; 3, Puerto Obaldía (San Blas), 3 April 1963, C. O. Handley, Jr.; 1, Cerro Malí (Darién), 8 February 1964, C. O. Handley, Jr. From *Phyllostomus* sp. (!) : 1, Chilibrillo Cave, 2 May 1957, Koford and Handley [USNM].

OTHER MATERIAL EXAMINED: About 250 specimens, mostly from various species of *Tonatia,* from COLOMBIA, SURINAM, ECUADOR, PERU and BOLIVIA are referred to this species. Five lots (28 specimens) taken from *Phyllostomus hastatus* in Amazonian COLOMBIA, by Kjell von Sneidern, were also examined.

REMARKS: We suspect that the specimens taken on *Phyllostomus hastatus* (subsp. ? *hastatus*) in Amazonian Colombia represent a third species, but to date we have not been able to distinguish between these and specimens from bats of the genus *Tonatia.* If these actually are *minuta,* then we must conclude that this species is able to live on bats of the genus *Tonatia* throughout the range of that genus, but on *Phyllostomus hastatus* only in Amazonian South America, and that it is replaced by *guimaraesi* on *P. h. panamensis* in northern South America and Central America.

Genus **Paratrichobius** Costa Lima

Paratrichobius Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Veter., Nictheroy, 5: 20 (diagn.), 25 (keyed), 28 (cat.). Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 12 (keyed), 19 (diagn.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 655. Curran, 1935, Amer. Mus. Novit., no. 765, p. 5 (keyed), 7 (discuss.). Jobling, 1936, Parasitology, 28: 359 ff. (morph.). Pessôa and Guimarães, 1937, Ann. Fac. Med. São Paulo, 12: 265, 267 (discuss.). Jobling, 1939, Parasitology, 31: 490 (diagn.). Bequaert, 1940, Rev. Acad. Colomb., Cienc. Exact., Fis. y Nat., 3: 417 (keyed) ; 1942, Bol. Ent. Venez., 1: 86 (keyed). Jobling, 1949, Parasitology, 39: 321 (keyed). Hoffmann, 1953, Mem. Congr. Cient. Mex., 7: 177 (keyed), 187. Maa, 1965, Jour. Med. Ent., 1: 389 (cit., cat.).

Type-species: *Trichobius longicrus* Miranda Ribeiro, 1907.

Paratrichobius, and the related genera, *Neotrichobius* and *Megistopoda* appear to have been derived from the *phyllostomae* group of the genus *Trichobius.* All of these occur on fruit-eating bats of the subfamilies Stenoderminae or Sturnirinae. They share a number of characters, including the large multi-faceted eyes; the presence of a female postgenital sclerite, similar to that found in the *caecus* group of *Trichobius;* the fusion of the cerci to the ventral arc in the female; and the distal insertion on at least one gonapophysis (male) of at least one of the ventral, paired gonapophyseal setae. In addition, *Paratrichobius, Neotrichobius,* and *Megistopod*a have a very similar shield-like thoracic venter. *Paratrichobius* appears to be the least, and *Neotrichobius* the most specialized genus.

The species of *Paratrichobius* have presented us with some of the most difficult taxonomic problems in the current study. Unfortunately, the paucity of material has prevented us from resolving many of these problems. Only two species, *P. longicrus* (M. Ribeiro) and *P. dunni* (Curran), have been described, but it is obvious from our material that a number of species, or other segregates, occur on various genera and species of the host bats. In Panama, the most confusing complex, taxonomically, is a series of segregates related to *P. longicrus* that occur on *Artibeus toltecus, A. aztecus, A. jamaicensis, A. lituratus palmarum,* and *Vampyrops vittatus.* They are very similar in chaetotaxy, but they differ, some conspicuously, in relative and absolute length of the wings and hind femora, and some in the number of setae present on sternum II and on the female seventh sternites. Our series are too small to permit significant analysis of these differences. Further, it appears that there may have been some contamination, temporary transfers, and misidentifications of hosts, which complicate analysis of the data.

The *Paratrichobius* from *A. jamaicensis* and *A. lituratus* (fig. 88A) differ from the others in having less strongly curved male gonapophyses, which are nearly identical in both samples. Their measurements, too, are very similar, though the specimens from *A. jamaicensis* appear to be slightly smaller and to have shorter wings in the male than do those from *lituratus.*

The segregates from *A. aztecus, A. toltecus,* and *Vampyrops vittatus* have more strongly curved male gonapophyses (fig. 88B–D). As can be seen in fig. 89, the specimens from *V. vittatus* have longer wings than do any others excepting those from *A. aztecus,* and they differ significantly from all others in the small number of discal and submarginal setae on sternum II. The specimens from *A. toltecus* have shorter hind femora than do any others of this complex, and in this respect they approach *dunni* (Curran), *salvini* n. sp., *lowei* n. sp., *sanchezi* n. sp., and species A and B from *Chiroderma villosum* and *Vampyrops helleri,* respectively. The least reliable measurements are those of the hind femora. These appear to be bowed more than normally under certain conditions of preservation, especially after treatment with KOH, and mounting on slides.

It is our opinion that at least some of these segregates are either cryptic species or populations that are now speciating on the Stenoderminae. Interestingly, the taxonomic complexities in the *longicrus* complex roughly parallel those of their hosts. It would seem that the hosts and their parasites are at the various levels of taxonomic differentiation to be expected in groups that are rapidly evolving. However, it is also possible that the segregates of the *longicrus* complex represent different developmental responses to different hosts or ecological situations, or represent local popu-

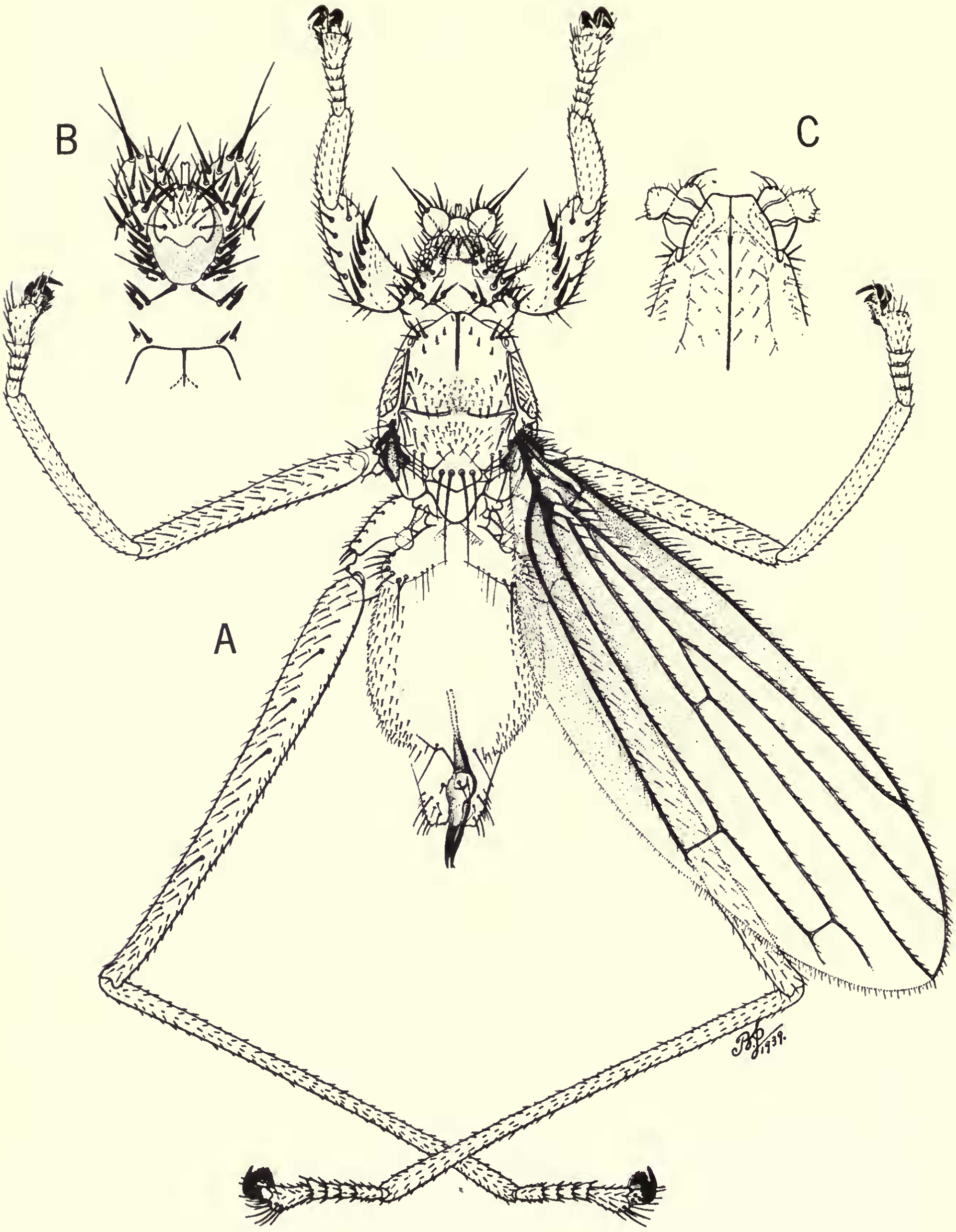

Fig. 86. *Paratrichobius longicrus* (M. Ribeiro), male from *Artibeus j. palmarum*, Trinidad. A, dorsal view. B, underside of head. C, anterior portion of venter of thorax. From Jobling (1939a).

lation differences in gene frequency. Much more material and biological information are needed in order to pursue these problems further. The altitudinal distribution of the hosts should be noted (fig. 89) in evaluating the differences between the flies.

Paratrichobius longicrus (Miranda Ribeiro). Figure 89.

Trichobius longicrus Miranda Ribeiro, 1907, Arch. Mus. Nac., Rio de Janeiro, **14**: 236, pl. 25—Quinta da Boa Vista [Rio de Janeiro], Brazil, from *Artibeus jamaicensis* (? Museu National de Rio de Janeiro).

Paratrichobius longicrus Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, **5**: 20, pl. 1, fig. 3 (wing). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 656 (cat.). Pessôa and Guimarães, 1937 (part. ?), Ann. Fac. Med. São Paulo, **12**: 265 (cit. host records). Jobling, 1939, Parasitology, **31**: 492 (part., record from *A. jamaicensis*, Brazil only). 1949, ibidem, **39**: 327 (part., records from *A. jamaicensis*, Brazil only).

We provisionally accept the determination of the type host of *P. longicrus* as *A. jamaicensis,* though it may have been incorrect.[10] The type host was later given by Jobling (loc. cit.) following Stiles and Nolan (1931), as *A. j. jamaicensis.* This is an obvious error. The nominate race of *jamaicensis* does not occur in southern Brazil.

We assign the Panamanian specimens taken from *A. j. jamaicensis* to *P. longicrus.* However, it is possible that *A. jamaicensis* is parasitized by a different species of *Paratrichobius* in southern Brazil than it is in Panama. It is our opinion that this bat does not normally harbor a species of *Paratrichobius,* but instead harbors *Megistopoda aranea* (Coquillet). Of 103 Panamanian specimens of *A. j. jamaicensis* that were parasitized by Streblidae, 56 (54.4%) carried *M. aranea* and only 4 (3.8%) carried a *Paratrichobius* sp. (a total of 5 specimens). Other typical parasites of *jamaicensis,* such as *Aspidoptera busckii* and *Metelasmus pseudopterus* occurred on 49.5% and 20.4% of the parasitized hosts, respectively. Only parasites that were obvious transients or contaminants, like *Trichobius joblingi* n.sp. or *Strebla vespertilionis* showed as low an incidence of parasitization as did *Paratrichobius longicrus.* This suggests that *A. jamaicensis* is acquiring its *Paratrichobius* from another lowland host, possibly *A. lituratus palmarum.* The only specimens which show close concordance in their measurements with those from *jamaicensis* are those from *A. lituratus.* However, in spite of the small number of specimens measured, the differences between individuals from the two hosts lead us to treat them separately until further data permit clarification of their status. The average number of discal setae on sternum II was 14 in both sexes, with a range of 12–16.

PANAMANIAN MATERIAL EXAMINED: From *Artibeus j. jamaicensis,* 5 (4 bats), as follows: 2, Almirante (Bocas del Toro), 28 January 1960; 1, Fort Kobbe (Canal Zone), 13 October 1960; 1, Guánico (Los Santos), 12 January 1962; 1, La Laguna (Darién), 17 June 1963, GML.

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[10] The taxonomy of the genus *Artibeus* has been much confused. A revision by C. O. Handley, Jr. is in press.

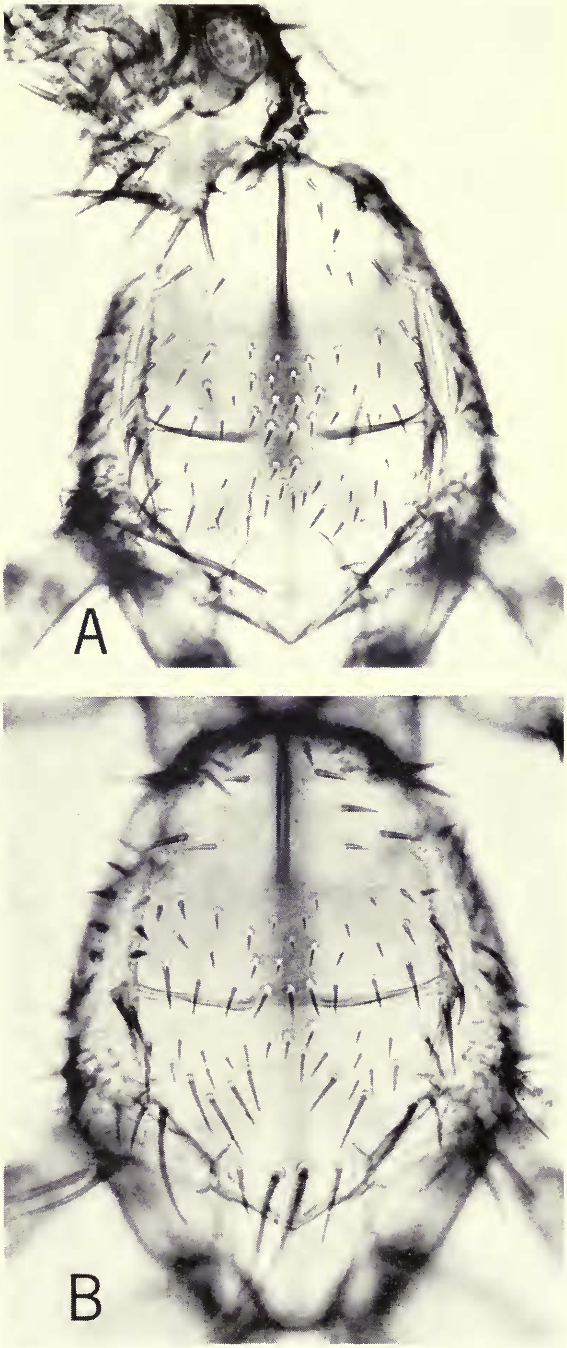

Fig. 87. Thorax, dorsal view, *Paratrichobius* spp. (*longicrus* complex). A, male from *Vampyrops vittatus* (no. 8612) Río Changena Camp (Bocas del Toro). B, male from *Artibeus aztecus* (no. 10344), Casa Tilley, Cerro Punta (Chiriquí).

Paratrichobius sp. (? *longicrus* M. Ribeiro) from *Artibeus lituratus palmarum*. Figures 86, 88A, 89, 91B.

Paratrichobius longicrus (? not M. Ribeiro, 1907). Jobling, 1939, Parasitology, 31: 490–92, (part., from *A. jamaicensis palmarum*), fig. 2. Bequaert, 1942, Bol. Ent. Venez., 1: 88. Jobling, 1949, loc. cit., **39**: 316–317 (part., from *A. jamaicensis palmarum*), fig. 1B, C. Goodwin and Greenhall, 1961, Bull. Amer. Mus. Nat. Hist., 122: 261. Starrett and de la Torre, 1964, Zoologica, **49**: 61.

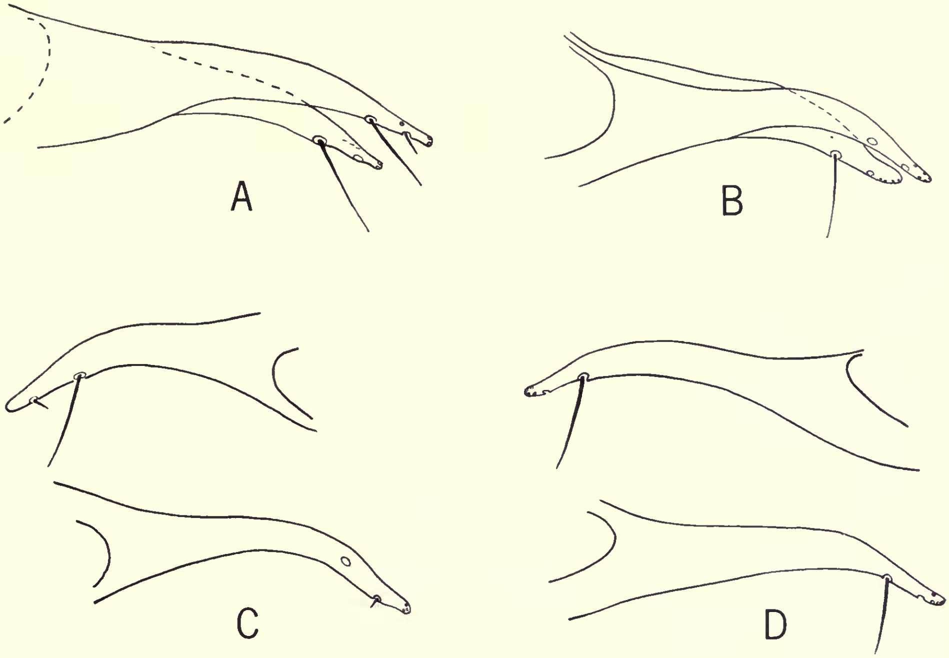

Fig. 88. Male gonapophyses, *Paratrichobius* spp. (*longicrus* complex). A, *P. longicrus* (M. Ribeiro), left gonapophysis, specimen from *Artibeus lituratus* (CNHM no. 94666), Morretinho (São Paulo), BRAZIL. B, left gonapophysis, specimen from *Artibeus aztecus* (no. 10344), Casa Tilley, Cerro Punta (Chiriquí). C, right (upper) and left (lower) gonapophyses of specimen from *A. toltecus* (no. 8116), near Mojica (Bocas del Toro). D, same of specimen from *Vampyrops vittatus* (no. 8612) Río Changena Camp (Bocas del Toro).

Mr. B. Jobling informed us (pers. comm.) that the specimen figured by him (1939, 1949) as *P. longicrus* is from *Artibeus jamaicensis palmarum* (= *A. lituratus palmarum*).

The small numbers of *A. lituratus palmarum* and its parasites that were collected and examined in Panama make it difficult to analyze the parasites of this host. It may be that *palmarum* is normally parasitized only by *Paratrichobius*. These were recovered from 12 (70.6%) of 17 host bats parasitized by Streblidae. A single specimen of *Aspidoptera phyllostomatis* was also taken from them as were two *Megistopoda aranea*.

Although the sample is small, the wing measurements (fig. 89) of the specimens from *A. lituratus palmarum* suggest that two categories of wing lengths are represented. The "long-winged" males and females are from Bocas del Toro (22 mi. S. of Changuinola), while all of the "short-winged" forms except one (from Sibube, Bocas del Toro) are from San Blas. The short-winged forms have fewer discal setae on sternum II, 9–11 in the male, as opposed to 16–18 in the long-winged forms.

Among various possibilities, it may be suggested the long and short-winged forms could represent contaminations, geographic segregates, dimorphism, or different host segregates. The latter should not be overlooked in view of the complex taxonomic problems in the genus *Artibeus*. Extensive and geographically representative collections are needed to clarify the status of the *Paratrichobius* on *A. lituratus*.

PANAMANIAN MATERIAL EXAMINED: From *Artibeus lituratus palmarum* (18 flies in 9 lots from 7 bats) as follows: 7, 22 miles south of Changuinola (Bocas del Toro), 7 September 1961; 1, Sibube (Bocas del Toro), 27 January 1963, C. O. Handley, Jr.; 2 (1 bat), railroad area south of Paráiso (Canal Zone), 5 November 1959; 5 (1 bat), Kobbe Beach (Canal Zone, 12 November 1956; 3 (3 bats), Barro Colorado Island (Canal Zone), 11 and 12 December 1956 and 12 January 1957.

Paratrichobius sp. (*longicrus* complex), from *Vampyrops vittatus*. Figures 87A, 88D, 89.

Specimens from this host differ rather markedly from the others in the small number of discal setae on sternum II. The number ranged from 7–13, with a mean of 10, in 22 specimens checked.

PANAMANIAN MATERIAL EXAMINED: 22 males and 10 females in 22 lots from 22 bats, as follows: 1, Rancho Caballero (Bocas del Toro), 11 September 1961; 2 (2 bats), Rancho Mojica (Bocas del Toro) and 1, near Rancho Mojica, 9 to 13 September 1961; 13 (9 bats), Río Changena Camp (Bocas del Toro), 28 September 1961; 6, Cerro Malí (Darién), elevation 4800 feet, 1 May and 1 to 6 June 1963, GML; 3, same locality, 4 February 1964, C. O. Handley, Jr.; 5, Cerro Tacarcuna (Darién), 4 and 7 March 1964.

REMARKS: Males were present on 20 of the 22 *Vampyrops vittatus* parasitized by *Paratrichobius,* whereas females were present on only eight. Seventeen bats had only a single fly; in 13 instances, these flies were males. Most of the hosts were collected in mist nets. We are not in a position to explain these sex ratios. It is possible that the females may leave the host more readily when disturbed, than do the males, or that a smaller percentage of them stay with the host bats when they leave the roost. It hardly seems likely that this differential represents the number of females that are off the host depositing pupae at any one time.

Paratrichobius sp. (*longicrus* complex) from *Artibeus aztecus*. Figures 87B, 88B, 89.

The wings of this form are the longest, in relation to the length of the hind femora, of any examined. The number of discal setae on sternum II

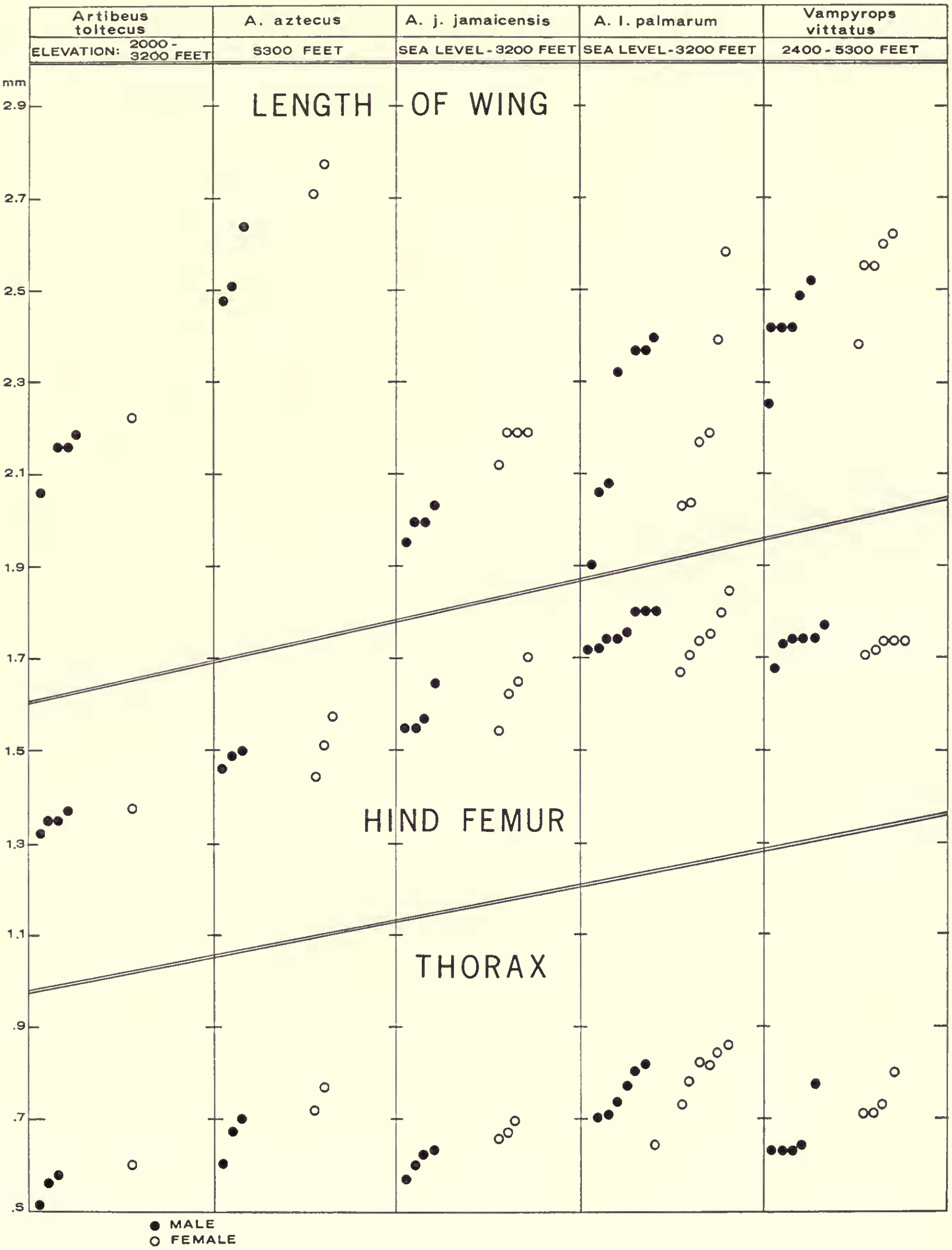

Fig. 89. *Paratrichobius longicrus* complex. Measurements of length of wing, hind femur, and thorax of specimens from hosts indicated at head of columns. All measurements are for specimens collected in Panama.

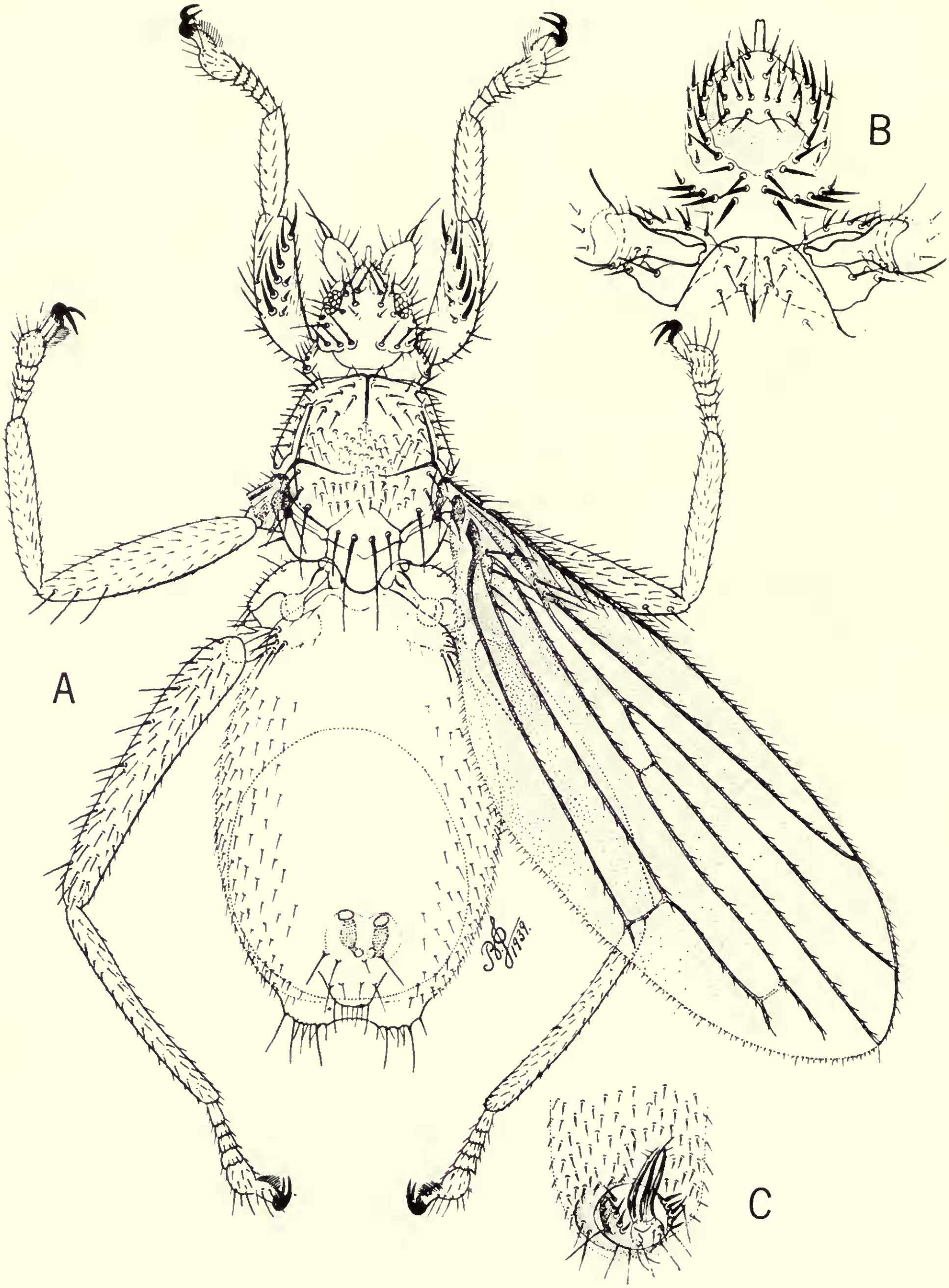

Fig. 90. *Paratrichobius dunni* (Curran). A, dorsal view, female. B, underside of head and anterior portion of sternopleura. C, apex of abdomen, male, ventral view. From Jobling (1939a).

was 11, 12, 16, and 17 in the four males, and 15 and 18 in the two females.

MATERIAL EXAMINED: 5 (1 bat), Casa Tilley (Chiriquí), 11 March 1962; 1, same locality, 1 May 1960.

Paratrichobius sp., from *Artibeus toltecus.* Figures 88C, 89.

Measurements could be made on only four of the six specimens taken from *A. toltecus.* These flies are smaller than any of the others, but have proportionately longer wings. The number of discal setae on sternum II ranged from 11–15 (12 on the single female), with a mean of 13 for the four males.

MATERIAL EXAMINED: 6 (6 bats): 2, Rancho Mojica (Bocas del Toro), 13 September 1961; 1, Río Changena Camp (Bocas del Toro), 20 September 1961; 2, Casa Lewis (Chiriquí), 1 and 5 February 1960; 1, Casa Tilley, Cerro Punta (Chiriquí), 24 April 1961.

Paratrichobius dunni (Curran). Figures 90, 91A, 92A.

Speiseria dunni Curran, 1935, Amer. Mus. Novit., no. 765, p. 7, fig. 6—El Real, Panama, from either "*Pteropteryx* [sic!] *canina* or *Uroderma bilobatum*" (American Museum of Natural History).

Paratrichobius dunni Jobling, 1939, Parasitology, 31: 492–494, fig. 3A–C. Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 418.

This distinctive species appears to be restricted to *Uroderma bilobatum.* It is related to *salvini,* but differs markedly in that the males possess spine-like setae along the ventro-apical margins of tergum IX (fig. 91A). It also differs in having more extensive prescutal chaetotaxy.

There can be little doubt that the type host of *P. dunni* was *Uroderma bilobatum,* since the species of *Paratrichobius* are apparently restricted to Stenoderminae. *Peropteryx* is a genus of Emballonuridae. The only streblid we have seen from *Peropteryx* is an undescribed species of *Trichobius.* Curran's two paratypes of *dunni* were taken from *U. bilobatum* at Summit (Canal Zone).

Measurements:	BL	TL	WL	WW	FL
Male	1.54–1.76	0.56–0.62	1.21–1.22	0.60	0.48
Female	1.59–1.76	0.59–0.63	1.35–1.59	0.63–0.69	0.49

PANAMANIAN MATERIAL EXAMINED: From *Uroderma bilobatum,* 146 flies in 41 lots (57 bats), as follows: 32 (17 bats), Summit Gardens (Canal Zone), 11 September 1959; 8, same locality, 31 May 1960; 17 (4 bats), palm trees, Fort Randolph (Canal Zone), 6 October 1959; 5, France Field, 3 August 1960; 9 (2 bats), Fort Davis (Canal Zone), 14 and 22 September 1960; 24 (11 bats), Fort Clayton (Canal Zone), 28 November 1960; 1, Almirante (Bocas del Toro), 28 January 1960; 1, Sibube (Bocas del Toro), 26 January 1963, C. O. Handley, Jr.; 1, Escobal (Colón), 28 September 1960; 9 (4 bats), Punta de Cocos, Isla del Rey (Darién), 22 and 25 March 1960; 7 (5 bats), Punta de Piña (Darién), 24 March 1960; 8 (7 bats), Puerto Obaldía (San Blas), 3 and 4 April 1963, C. O. Handley, Jr. and F. M. Greenwell; 24, Armila (San Blas), 29 March and 1 April 1963, same collectors.

REMARKS: A single specimen was labeled as from *Vampyressa* sp., Río Mandinga (San Blas), GML, 29 May 1957. *Uroderma bilobatum* was collected on the same day and it is possible that the specimen of *dunni* was a stray from *Uroderma.*

Paratrichobius lowei Wenzel, new species. Figures 92B, 93.

Superficially resembling *P. dunni* (Curran) in size and mesonotal chaetotaxy and, like it, having spine-like setae along ventro-apical margin of tergum IX. It differs in having an irregular oblique double row of setae, the upper two or three minute but distinct, medial and parallel to the row of heavy profemoral setae in *dunni* this row is incomplete and two or three of the upper setae are short spines. It also differs from *dunni,* and from all other known species of the genus, in that the usual profemoral spines are only strong setae.

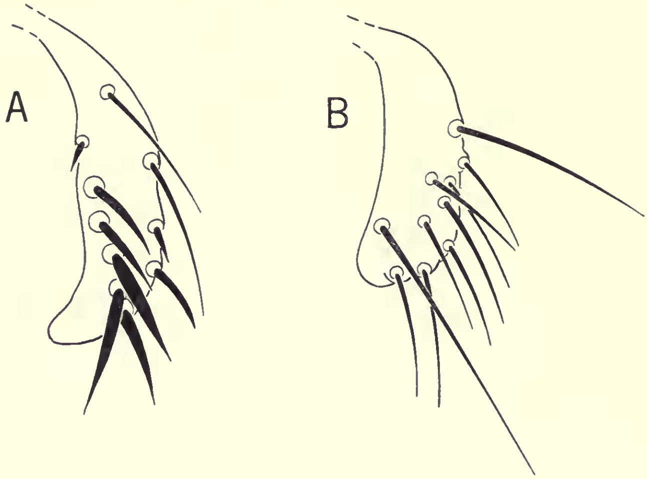

Fig. 91. Left side of tergum IX (of male hypopygium), ventral view of ventro-apical margin. A, *Paratrichobius dunni* (Curran), from *Uroderma bilobatum,* Summit Gardens (Canal Zone). B, *P. longicrus* (M. Ribeiro), from *Artibeus lituratus* (same data as fig. 88A).

DESCRIPTION: *Head.*—Eyes with 25–27 facets. Laterovertices with six setae, all strong, except for a very short weak seta in postero-lateral angle. Occipital lobes with about six strong long marginal setae plus a very long one (about as long as head) on antero-lateral lobule; posterior and ventral to these a row of six to eight shorter but strong subspiniform setae; one or two of marginal occipital setae are conspicuously longer macrosetae, one at medial edge, another one-third from inner margin. Postgenae on each side behind oral cavity with four or five short spinelets in a transverse row; posterior to the outer spinelets are two or three shorter, finer ones.

Thorax.—Anterior margin of prescutum biconcave for reception of occipital lobes, projecting at middle; median suture extending to about middle, transverse suture interrupted at middle; a spiracular and prespiracular bristle present; anterior half of prescutum with 13–14 additional stronger setae; basal half with similar setae laterally, setae becoming fine and dense at middle. Scutum with long strong setae along sides, these continued medially as a W-shaped antescutellar row whose bristles are slightly shorter and finer medially, two or three at middle conspicuously shorter; scutum elsewhere with dense fine short setae. Mesepisternum above with 16–20 bristles.

Median pleurotrochantinal lobe long, apically narrowed, sharply reflexed dorsally but not united with the metepimeron. *Wings.*—R_s varying in length from slightly less to slightly more than twice distance from fork to crossvein *r-m;* R_1 with setae to base. *Legs.*—Inner (anterior) face of profemora with a diagonal row of six stout bristles rather than spines, ventral to these an irregular row of six or seven short setae, the basal one minute; ventral half of inner face with numerous short bristles. Bristles of submarginal row on outer face of hind femur distinctly projecting beyond ventral margin of femur throughout its length.

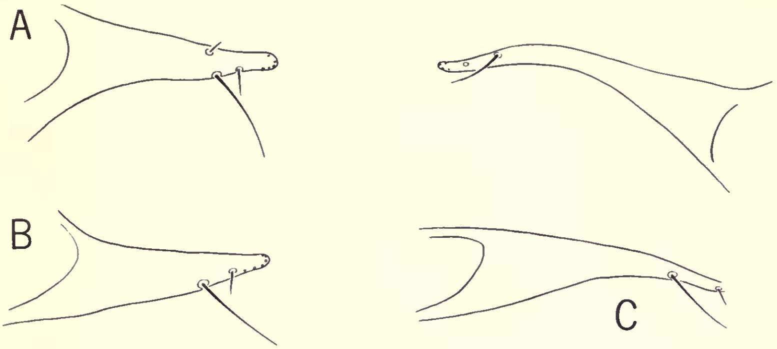

Fig. 92. Male gonapophyses of species of *Paratrichobius.* A, left gonapophysis, *P. dunni* (Curran), from *Uroderma bilobatum* (no. 6591), Fort Clayton (Canal Zone). B, same, *P. lowei,* new species, paratype from *Artibeus cinereus* (no. 11428), Armila (San Blas). C, right (upper) and left (lower) gonapophyses, *P. sanchezi,* new species, paratype from *Enchisthenes hartii* (MA no. 389), Rancho Grande (Aragua), VENEZUELA.

Abdomen.—Lateral lobes of tergum I+II each with three or four fine shorter bristles along inner dorsal margin; posterior margin with a double row of about 12–13 coarse bristles, those of anterior row longest; setae becoming shorter ventrally. Sternum I with three spine-like bristles on each lateral lobe. Sternum II with 30–34 discal setae in a median triangular area; posterior margin with 20–22 bristles, those near middle of about same length as discals, the outer ones a little longer. Dorsal connexivum bare, with four pairs of minute segmental setae; lateral and ventral connexivum covered with nearly uniform, short, conspicuous setae, these slightly longer basally on ventral connexivum. Mesepimeron (above) with 16–20 bristles. *Female:* Tergum VII transverse, its anterior margin slightly emarginate at middle; with a pair of lateral macrosetae and between and slightly posterior to these a pair of short setae. Supra-anal plate with four apical macrosetae and on each side near mid-length, a short seta. Seventh sternites with 9–12 setae, one a conspicuously long macroseta. *Male:* Sternum V with setae of apical margin mostly of about the same size as discals, excepting a pair of macrosetae on each side. Hypopygium dorsally with a postero-lateral macroseta and a shorter seta on each side of sternum VII+VIII; tergum IX apically with a row of about six fine macrosetae, and on each inner ventro-apical margin a row of about five stout setae, the three middle ones spine-like; a short seta anterior to these. Gonapophyses as in fig. 92B.

Measurements:	BL	TL	WL	WW	FL
Male	1.48–1.73	0.36–0.38	1.50–1.58	0.63–0.66	0.82–0.85
Female	1.76–1.95	0.41–0.44	1.59–1.74	0.66–0.71	0.80–0.91

TYPE MATERIAL: Holotype male (slide) from *Artibeus cinereus watsoni* (host no. 11964), Armila (San Blas), 27 March 1964, Charles O. Handley and Francis M. Greenwell. Allotype female, same locality, collectors and host (no. 11678), 16 March 1963; in the collection of Chicago Natural History Museum. Paratypes.—5, same data as the holotype, but 28 February to 4 March 1963; 2, same host, Río Tuira (Darién), 8 March 1958, P. Galindo [GML]. Paratypes in the collections of Chicago Natural History Museum, the United States National Museum, and the Gorgas Memorial Laboratory, Panamá, Panamá.

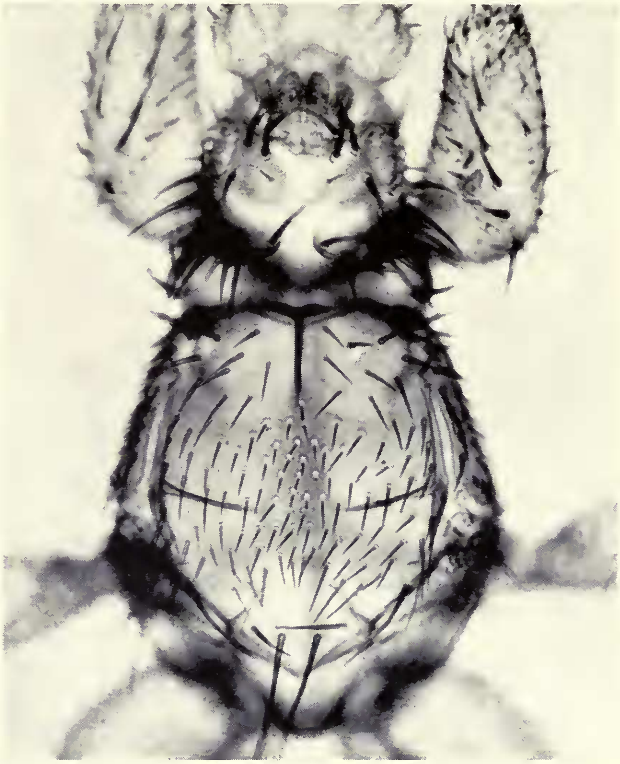

Fig. 93. Thorax, dorsal view, *Paratrichobius lowei*, new species, holotype.

REMARKS: This species is named for Mr. Wilbur Lowe, in appreciation of his valuable assistance in the laboratory of the Environmental Health Branch, at Corozal.

Paratrichobius sanchezi Wenzel, new species. Figures 92C, 94.

Similar in size and appearance to *P. dunni* but differing markedly in having a row of seven to eight short setae parallel to the stout spines on the inner face of the profemur and in lacking stout spine-like setae along inner ventro-apical margins of tergum IX. Also resembling *P. lowei* n.sp., but in *lowei* the usual prefemoral spines are represented by strong setae; as in *dunni,* the ventro-apical margins of tergum IX have spinelike setae.

DESCRIPTION: Head.—Eyes large, with ±25 facets. Laterovertices with six setae, the most anterior ones very short, the most postero-medial seta as well developed as most others, but the seta immediately anterior to it a conspicuously long macroseta. Occipital lobes narrow, posterior margin festooned with six stout marginal setae and, postero-ventral to these, five or six short spine-like setae; antero-laterally is a much longer macroseta that is conspicuously longer than the head. Postgenae, posterior to oral cavity, with one or two short black thorn-like setae on each side, and posterior to these, two others, followed by four or five fine stout setae.

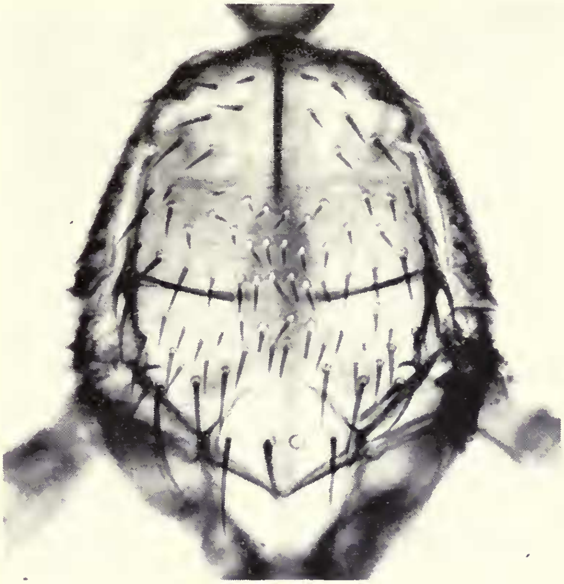

Fig. 94. Thorax, dorsal view, *Paratrichobius sanchezi,* new species, paratype female from *Enchisthenes hartii* (MA no. 326), Rancho Grande (Aragua), VENEZUELA.

Thorax.—Prescutum about as long as broad; anterior margin biconcave for reception of occipital lobes, slightly but distinctly produced at middle. Median suture extending posteriorly beyond middle; transverse suture indistinct at middle. Prescutum with eight or nine setae on each side of anterior half, the three antero-lateral bristles coarser and longer, one small bristle each side of median line on anterior projection; posterior half with two or three bristles along margin of longitudinal cleft, and about 10 in front of transverse suture, these becoming shorter and finer medially; anterior to these an irregular transverse band of 15–22 fine shorter setae. Scutum with a W-shaped row of 12–14 coarse bristles and anterior to these an irregular W-shaped row of 14–18 shorter bristles, similar to median setae in front of transverse suture. Mesepisternum with about 21 bristles in an irregular double row along dorsal and posterior margin, these coarser and longer along dorsal edge. Venter with scattered fine setae; a short angulate pleurotrochantinal lobe present. *Wings.*—R_s about twice as long as distance from fork to *r-m.* All longitudinal veins except costa with extensive bare areas basally, those of fifth and sixth veins twice as long as the others. Profemora as in *dunni* but with a row of seven or eight short setae medial to and paralleling the oblique row of six stout spines. Hind femora and tibiae slightly bowed, the femora clothed with short semi-recumbent setae except along inner face on basal third; about six conspicuously longer setae on dorsal margin and a lateral one near apex; ventral submarginal row projecting below margin and visible in profile for entire length.

Abdomen.—Inner dorsal margins of lateral lobes of tergum II each with three or four fine setae, posterior margin with 9–12 coarse setae, the most dorsal of these longest. Connexivum bare dorsally along middle except for four pairs of well-developed segmental setae; lateral connexivum with very short setae, the ventral setae conspicuously longer. Sternum I with two or three spines on each side. Sternum II with 10–12 discal and ±14 marginal setae. *Female:* Tergum VII with a macroseta on each side and medial and posterior to these a pair of short setae. Supra-anal plate with four apical macrosetae and a short seta on each side near mid-length. Seventh sternites with 10–13 setae, most of them rather short, two or three much longer, one a conspicuously long macroseta. *Male:* Hypopygium with a macroseta on each side on sternum VII+VIII; tergum IX fringed apically with nine or ten macrosetae; IX also with six or seven shorter setae ventro-laterally on each side. Gonapophyses as in fig. 92C, slender, sinuate above near apex.

Measurements:	BL	TL	WL	WW	FL
Male	1.54–1.99	0.66–0.68	1.81–1.99	0.71–0.73	1.07–1.15
Female	1.70–1.78	0.60–0.67	1.90–2.03	0.71–0.80	1.08–1.17

TYPE MATERIAL: PANAMA.—Holotype male from *Enchisthenes hartii* (GML host no. 400,370), Cerro Malì (Darién), elevation 4800 feet, 6 June 1963, GML; allotype female same host (no. 9807-B), Cerro Hoya (Los Santos), 8 February 1962, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum. Paratype.—A female, same data as the allotype, but 9 February 1962.

VENEZUELA.—Paratypes, from *Enchisthenes hartii:* 2, Biological Station, Rancho Grande (Aragua), 1090 meters elevation, 10 August 1962, C. Machado and R. Antequera; 4, same locality but 21 August 1962, J. V. Scorza and C. Machado; 8, same locality, 29 August 1962, J. V. Scorza and C. and A. J. Machado. Paratypes in the collections of the United States National Museum; Chicago Natural History Museum; Faculdad de Ciencias, Universidad Central de Venezuela; and the Gorgas Memorial Laboratory, Panamá, Panamá.

REMARKS: This species is named for Mr. Pantaleon Sanchez, of the Environmental Health Branch at Corozal, in appreciation of his valuable assistance in the field work in Panama.

Paratrichobius salvini Wenzel, new species. Figures 95, 96C.

Similar to *P. dunni* (Curran); like it having only a couple of spinelets and a bristle medial and parallel to upper end of oblique row of profemoral spines, rather than a complete row of setae; differing from *dunni* in having a longer thorax and less dense and extensive mesonotal chaetotaxy; and in having normal rather than spine-like setae along ventro-apical margins of tergum IX.

DESCRIPTION: Head.—Dorsum as in *lowei;* the seta in postero-median angle of laterovertices very short, weak. Postgenae with a row of about five spinelets on each side behind oral cavity, the outer ones shorter; above and posterior to these another small spinelet and several fine short setae. *Thorax.*—Prescutum on anterior half with spiracular and prespiracular and about 12 other semi-erect or erect bristles, separated from semi-recumbent setae of posterior half by a bare transverse area; setae at sides of posterior half longer and stronger than those at middle, which form a small dense patch.

Scutum with an irregular W-shaped row of minute setae in front of the antescutellar row. Mesepisternum with about 14 bristles along dorsal margin. Pleurotrochantinal lobe long, tapered, sharply reflexed dorsally, not united with metepisternum. *Wings.*—R_s about twice as long as distance from fork to crossvein *r-m*. *Legs.*—Inner (anterior) face of profemora with a minute bristle and two short spinelets medial to upper end of oblique row of seven spines and another one or two very short but stout setae near apex of row; last spine of oblique row curved; inner face medial to these otherwise without setae except four or five very short ones near base. The hind femora not markedly swollen basally; setae of ventral submarginal row very short and inconspicuous apically, not projecting beyond lower edge of femur.

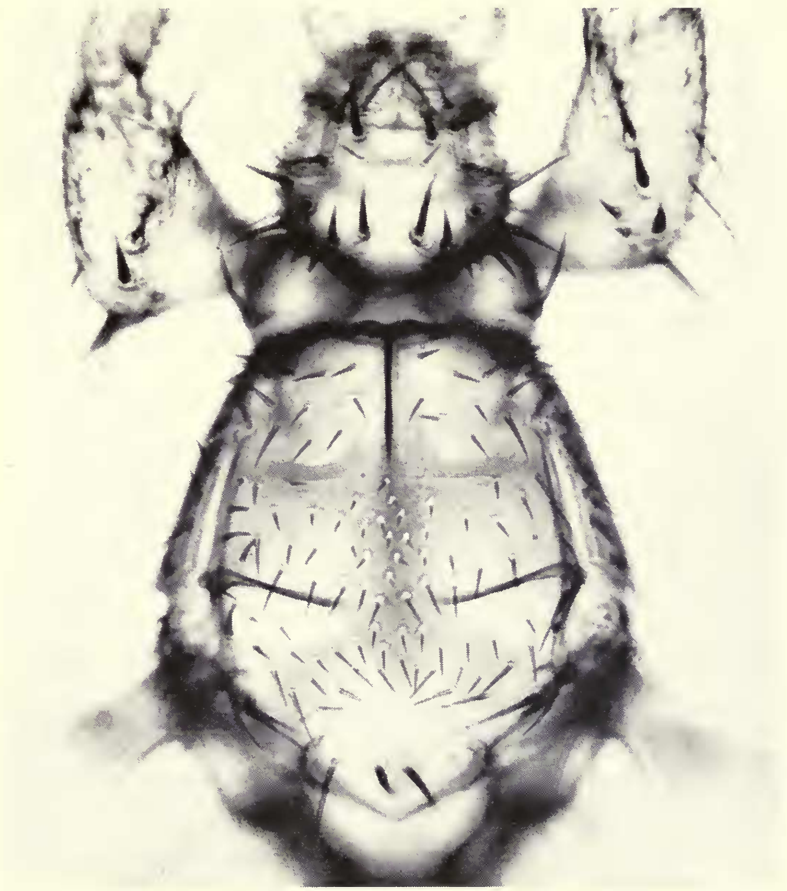

Fig. 95. Thorax, dorsal view, *Paratrichobius salvini*, new species, female from *Chiroderma salvini* (GML no. 300,079), Tacarcuna (Darién).

Abdomen.—Lateral lobes of tergum I+II with about three or four very fine setae on inner dorsal margin and a double row of about 12–14 coarse setae on posterior margin, these shorter ventrally. Connexival setae short, slightly longer ventrally; mid-dorsum bare except for four pairs of minute segmental setae. *Female:* Tergum VII transverse, narrowly elliptical; chaetotaxy of VII and supra-anal plate as described for *lowei* and *sanchezi*, the macrosetae fine. Sternum II with about 23–27 discal and 14–16 evenly distributed marginal setae, these shorter posteriorly, both on disk and along margin;

seventh sternites with about 10 setae, one or two conspicuously long. Discal and lateral marginal setae a little heavier, a pair of long slender setae each side of middle, separated by a pair of short setae. *Male:* Sternum II with 14–28 discal and 18–26 marginal setae. Sternum V feebly sclerotized, only about half as wide as sternum II; setae rather uniformly short except for setae of apical margin which are slightly longer and become longer laterally, two or three long setae on each side near outer margin, one a conspicuously long macroseta. Hypopygium with a dorso-lateral macroseta and a short seta on each side of sternum VII+VIII; tergum IX with an apical row of about eight macrosetae, four or five shorter setae along ventro-apical margin, and two others anterior to these.

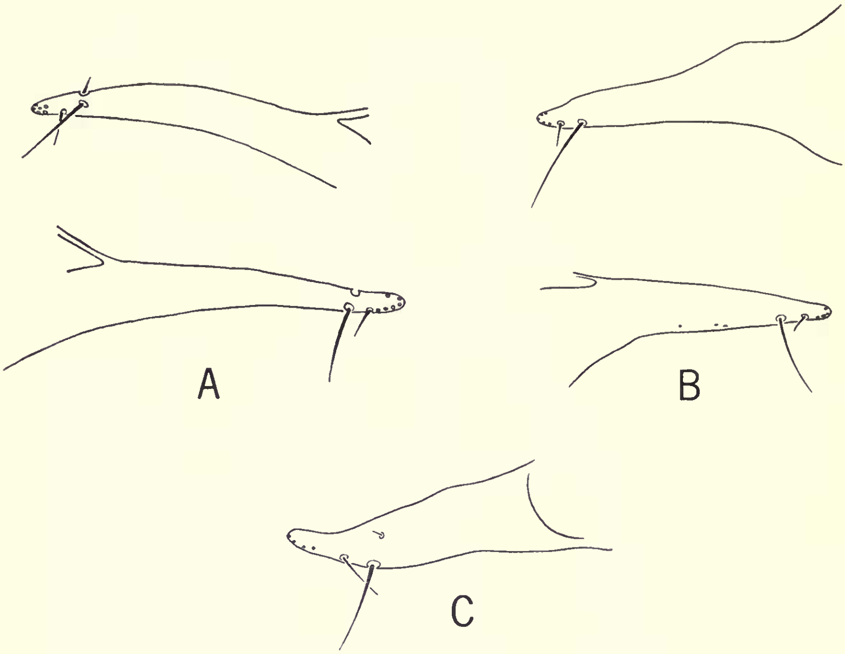

Fig. 96. Male gonapophyses of species of *Paratrichobius*. A, right (upper) and left (lower) gonapophyses of specimen from *Chiroderma villosum jesupi* (no. 12211), Puerto Obaldía (San Blas). B, same, of specimen from *Vampyrops helleri* (no. 10004), Cerro Hoya (Los Santos). C, right gonapophysis, *Paratrichobius salvini*, paratype from *Chiroderma salvini* (no. 12990), Cerro Tacarcuna (Darién).

Measurements:	BL	TL	WL	WW	FL
Male	1.61–1.93	0.67–0.77	1.92–2.16	0.84–0.85	1.04–1.15
Female	2.06–2.32	0.63–0.80	2.19–2.32	0.85–0.88	1.26–1.32

TYPE MATERIAL: Holotype male and allotype female from *Chiroderma salvini* (host no. 12990), Cerro Tacarcuna (Darién), 8 March 1964, C. O. Handley, Jr. In the collection of Chicago Natural History Museum. Paratypes.—1 male, same data as the holotype; 1 male, same data but 6 March 1964. In the collections of the United States National Museum and Chicago Natural History Museum.

OTHER MATERIAL EXAMINED: 1 female, from *Chiroderma salvini* (?), Tacarcuna (Darién), elevation 2000 feet, 15 July 1963 [GML no. 300,079].

REMARKS: The female taken on 15 July 1963 is only tentatively associated with this species, because we were unable to verify the identification of the host. The specimen differs from the allotype in possessing a pair of discal macrosetae at mid-length on the supra-anal plate. We have not seen females from *Chiroderma villosum* (see below) to determine whether or not they possess such setae. If the host is correctly identified, then this character is probably variable as it is in some other streblids.

Paratrichobius sp. A. Figure 96A.

This appears to be a distinct species with shorter male gonapophyses than those of *P. salvini* n.sp., but we are unwilling to name it until additional material, including females, is available for detailed comparison with *salvini.*

MATERIAL EXAMINED (From *Chiroderma villosum jesupi*): 3 males, Puerto Obaldía (San Blas), 3 and 4 April 1963, C. O. Handley, Jr. and F. M. Greenwell; 1 male, Armila (San Blas), 17 March 1963, same collectors.

Paratrichobius sp. B. Figure 96B.

This appears to be a distinct species, similar to species A, but with gonapophyseal macrosetae inserted farther distad. Again, we are unwilling to name this in the absence of more extensive comparative material. The occurrence on *Vampyrops* of a species related to *dunni* and *salvini* is interesting. All other specimens from *Vampyrops* (sp., *dorsalis,* and *vittatus*) that we have examined are related to *Paratrichobius longicrus.*

MATERIAL EXAMINED (From *Vampyrops helleri*): 1 male, Cerro Hoya (Los Santos), 24 February 1962.

PROVISIONAL KEY TO THE PANAMANIAN SPECIES OF *PARATRICHOBIUS*

1. Inner face of profemora with only two or three short spinelets and/or setae medial and parallel to upper end of oblique row of spines or heavy setae (figs. 90, 95) 2

   Inner face of profemora with a complete row of setae medial and parallel to the oblique row of spines or strong setae (figs. 86, 93) 3

2. Mesonotal chaetotaxy as in fig. 90A. *Male:* Inner ventro-apical margins of tergum IX (of hypopygium) with spine-like setae (fig. 91A). Host: *Uroderma bilobatum* .... *dunni* Curran

   Mesonotal chaetotaxy as in fig. 95. *Male:* Inner ventro-apical margins of tergum IX with normal setae as in *P. longicrus* (fig. 91B). Hosts: *Chiroderma* spp., *Vampyrops helleri* .... *salvini* n.sp. (and species A, B)

3. Inner face of profemora with seven spines or stout setae in a diagonal row, the apical one curved. Hind femora short, no more than 1.26 mm. long 4

   Inner face of profemora with six stout spines, the apical one not curved. Hind femora longer, 1.32–1.77 mm. long .... *longicrus* complex

4. Inner face of profemora with stout spines. Mesonotal chaetotaxy as in fig. 94. *Male:* Inner ventro-apical margins of tergum IX with normal setae. Host: *Enchisthenes hartii* .... *sanchezi* n.sp.

   Inner face of profemora with strong setae, not spines, in diagonal row on inner face. Mesonotal chaetotaxy as in fig. 93. *Male:* Inner ventro-apical margins of tergum IX with stout spine-like setae as in *dunni* (fig. 91A). Host: *Artibeus cinereus* .... *lowei* n.sp.

Neotrichobius Wenzel and Aitken,[11] new genus

Type-species: *Neotrichobius stenopterus* Wenzel and Aitken, new species.

Very similar to both *Paratrichobius* and *Megistopoda* in the greatly elongated hind legs and in the structure of the underside of the thorax, which, though much narrower, is reminiscent of that of the Nycteribiidae. *Neotrichobius* resembles *Megistopoda* in possessing stenopterous wings, but in that genus the body is strongly, laterally compressed; the occipital lobes of the head are strongly elevated; the profemora lack spines on the inner face; and the paired ventral setae of the male gonapophyses are situated anterior to middle rather than subapically. *Neotrichobius* is more closely related to and possibly derived from *Paratrichobius,* which it resembles *inter alia* in the structure of the male gonapophyses (the paired ventral setae are subapical in both) ; in having a row of stout spines or setae on inner face of profemora; and in possessing strong spine-like setae on the dorsal sclerites of the head as well as on the theca and along sides of oral cavity. It differs from *Paratrichobius* in being stenopterous; in having subcylindrical profemora; and in that the dorsal abdominal connexivum is entirely covered with setae. *Neotrichobius* differs further from both *Megistopoda* and *Paratrichobius* in having the median suture bifurcate posteriorly; the scutum small and not separated laterally from the prescutum; a very small scutellum; and the mesopleuron traversed by a longitudinal membranous suture just dorsal to mesocoxal cavity.

DIAGNOSIS: *Head.*—Very similar to that of *Paratrichobius.* Laterovertices and occipital plates differentiated but much reduced in size and not strongly sclerotized; with strong spine-like setae. Palpi irregularly oval, ventral surface with a mixture of spines and normal setae; theca with spines and setae; sides of oral cavity margined with spine-like setae. *Thorax.*—Mesonotum longer than head. Anterior margin of prescutum produced at middle, emarginate on each side of projection, to accommodate occipital lobes of head. Median suture bifurcate posteriorly. Scutum not separated from prescutum laterally. Scutellum very small. Each mesopleuron divided into dorsal and ventral regions by a second longitudinal membranous fissure similar to that which separates the prescutum and episternum. Underside of thorax shield-like, the anterior and posterior margins rounded, the anterior sternopleural margin dorsally bent upwards like a ski. Pleurotrochantines not projecting as an angulate process on each side between meso- and metacoxae. *Wings.*—Stenopterous, venation greatly reduced, only three longitudinal veins basally, two apically. *Legs.*—Middle and hindlegs progressively much longer than the short forelegs; hindlegs greatly elongated, the hind femora extending beyond apex of abdomen; all femora with some macrosetae, in addition to short setae; middle and hind femora slightly bowed; profemora very stout, subcylindrical (much as in *Paradyschiria*), inner face armed with very heavy spines. Hind trochanters with spines along inner margin; hind coxae armed with spines above and below; hind tibiae bowed. Protarsi strongly compressed antero-posteriorly; middle and hind tarsi elongated, the first tarsomere twice as long as wide, as long as second and third combined.

Abdomen.—Lateral lobes of tergum I+II with strong spine-like setae on postero-lateral margins. Sternum I with spine-like setae at sides. Sternum II medially with both spine-like and normal discal setae; posterior margin, with spine-like setae, forming a pseudo-ctenidium. Connexivum entirely covered with setae, without a bare dorsal

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[11] Thomas H. G. Aitken, Trinidad Regional Virus Laboratory, Port-of-Spain, Trinidad.

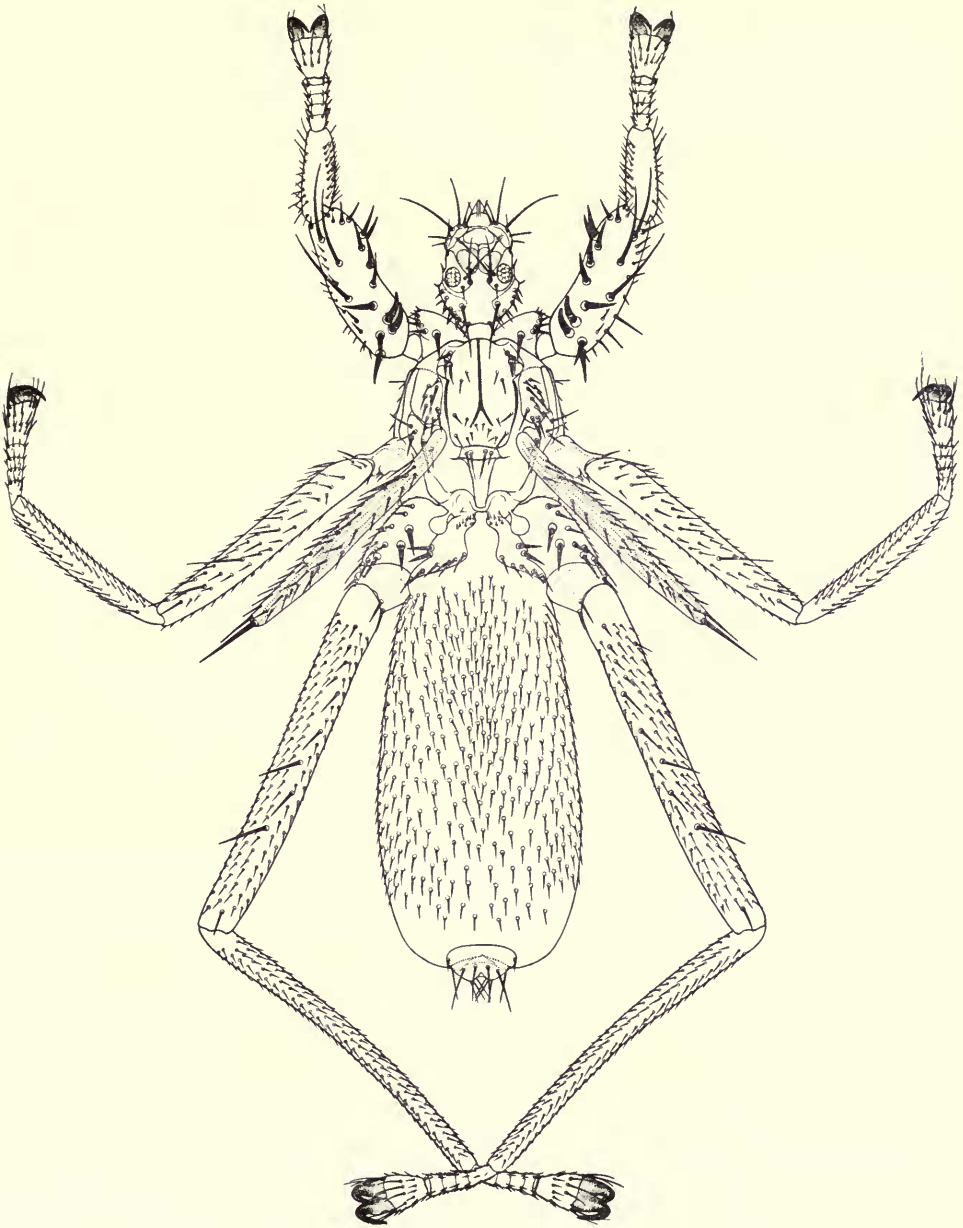

Fig. 97. *Neotrichobius stenopterus*, n. gen., n. sp. Female (allotype), dorsal view.

median longitudinal area; setae of upper and ventral sides similar in both sexes; lateral setae of connexivum shorter. *Female:* Tergum VII not evident. Supra-anal plate very short. Cerci united with ventral arc. Seventh sternites very small. *Male:* Hypopygium not strongly developed, but distinct. Sternum V present, transverse. Sternum VI absent. Gonapophyses as in *Paratrichobius*, the paired ventral setae subapical in position, the macroseta not strongly developed, the accessory seta anterior to macroseta.

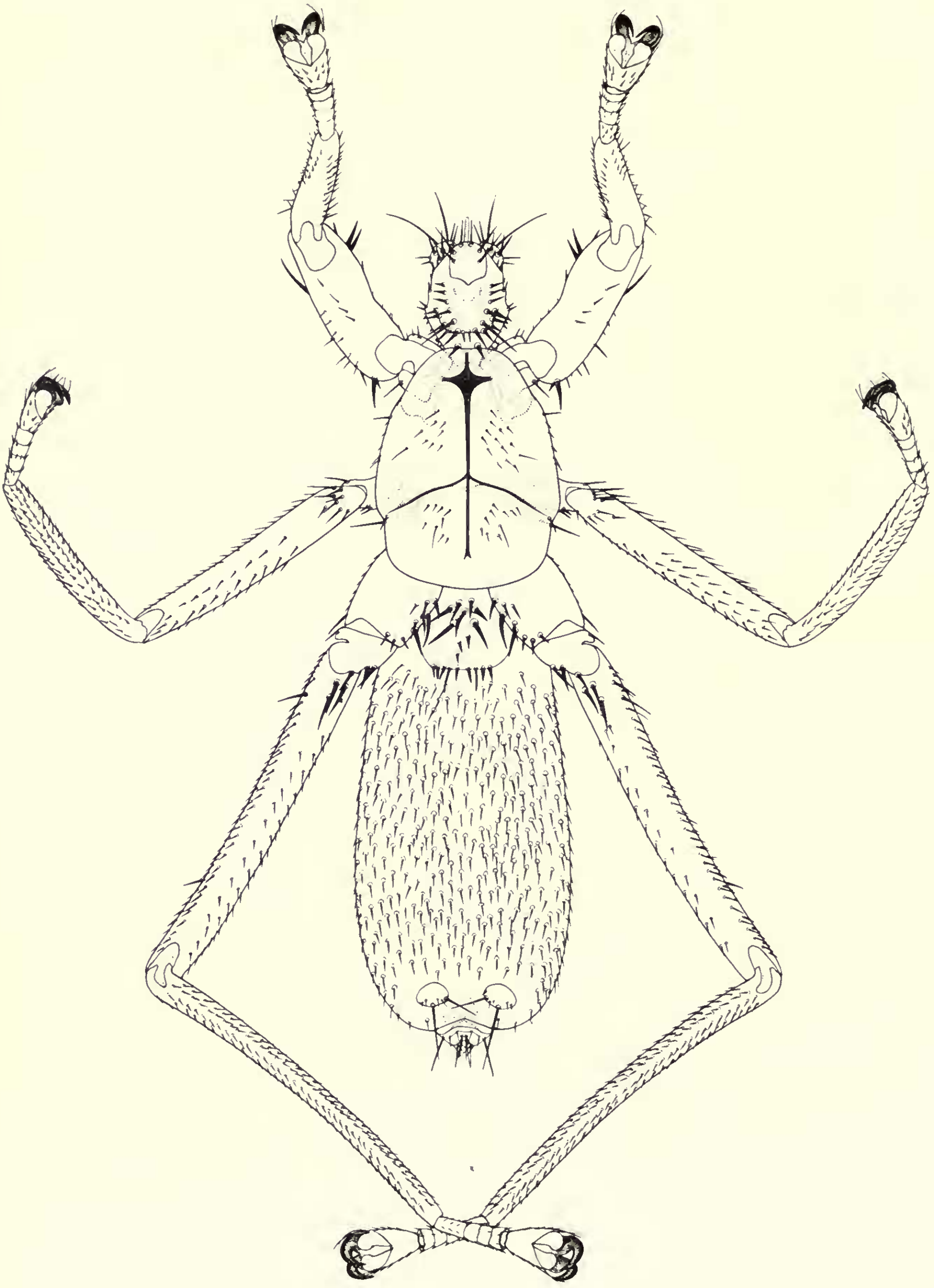

Fig. 98. *Neotrichobius stenopterus*, n. gen., n. sp. Female (allotype), underside.

Neotrichobius stenopterus Wenzel and Aitken, new species. Figures 97–99.

DESCRIPTION: *Head.*—More or less horizontal, longer than broad. Genae with a few short spine-like setae. Laterovertices microsetose, each with one macroseta, another seta about two-thirds as long, an intermediate-size seta, and two short setae; occipital plates not microsetose, with a very stout long macroseta and five very short spine-like setae; mediovertex microsetose, membranous. Posterior margin slightly emarginate at middle for reception of median prescutal projection. Eyes relatively conspicuous, with ±11 facets. Palpi irregularly oval, apical macroseta very long, ventral surface with six to eight setae, most of them spine-like. Theca with a pair of fine setae at apex and two spines on each side on apical half. Margin of oral cavity bordered with spine-like setae. *Thorax.*—Prescutum with two supraspiracular bristles, one or two short discal setae anterior to middle, and a pair near posterior margin. Scutum with eight to ten short bristles, and a long bristle at each lateral angle. Scutellum with a median pair of very long bristles and a shorter bristle on each side. Mesepisternum, above, with two or three long and five or six short bristles. *Wings* and *Legs* as illustrated.

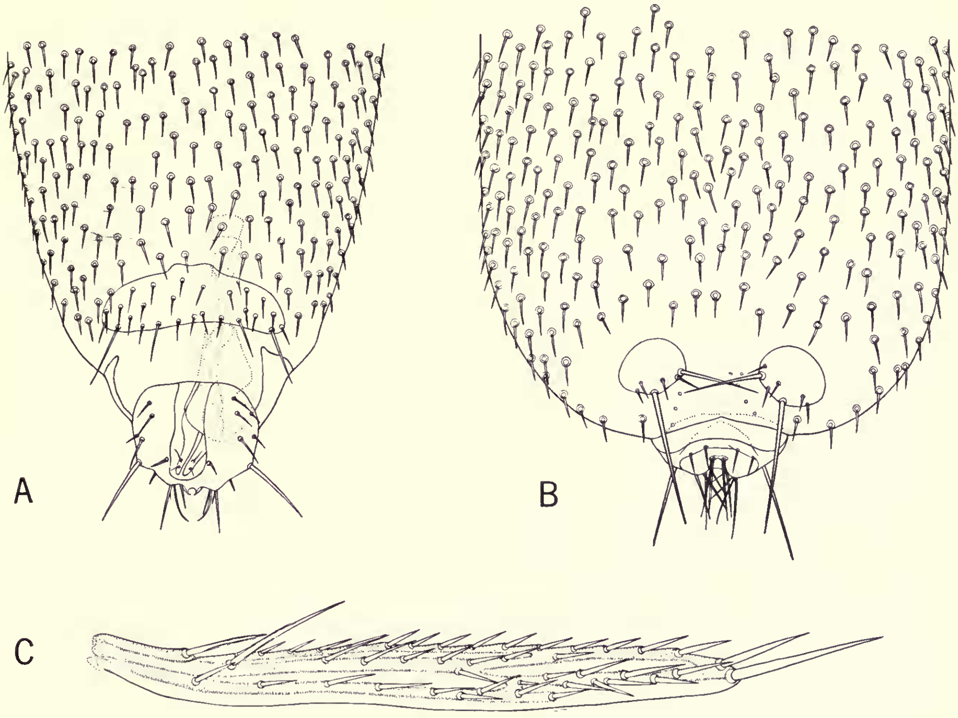

Fig. 99. *Neotrichobius stenopterus*, n. gen., n. sp. A, apex of abdomen, male (holotype), ventral view. B, same, female (allotype). C, wing.

Abdomen.—Tergum I+II with a transverse basal cluster of short setae; inner and posterior margins poorly defined, side margins of lateral lobes with a row of strong spine-like setae. Each lateral lobe of sternum I with two spine-like setae. Sternum II with two pairs of heavy spine-like setae and four or five short spine-like setae between them, followed on apical half by three to five short stout setae; apical margin with six to eight stout spine-like setae, and a pair of slender setae. Connexivum similar in both sexes, rather uniformly covered throughout with moderately heavy, fairly short setae, these shorter along sides, especially apically. *Female* (figs. 97, 98, 99B): Supra-anal plate as illustrated. Seventh sternites small, chaetotaxy as figured. *Male* (fig. 99A): Hypopygium without dorsal setae; a long slender seta on apical margin on each side, and lateral to it a short seta and a heavy macroseta; a short seta also present each side near base; ventral chaetotaxy as illustrated. Gonapophyses as in *Paratrichobius*, paired ventral setae subapical; macroseta only slightly longer than accessory seta.

Measurements:	BL	TL
Male	1.70–1.92	0.55–0.56
Female	2.03–2.09	0.49–0.58

TYPE MATERIAL: Holotype male and allotype female (slides) from *Uroderma bilobatum* (host no. 5492), Almirante (Bocas del Toro) 28 January 1960, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—From *Artibeus cinereus:* 3 (2 bats), Río Changena Camp (Bocas del Toro), elevation 2600 feet, 18 September 1961; 1, Cerro Hoya (Los Santos), 12 February 1962; 5 (4 bats), Armila (San Blas), 24 to 27 February 1963, C. O. Handley, Jr. and F. M. Greenwell. From *Artibeus j. jamaicensis:* 1, Cerro Hoya (Los Santos), 9 February 1962. From *Vampyressa pusilla:* 1, Armila (San Blas), 18 March 1963, C. O. Handley, Jr. and F. M. Greenwell; 1, La Laguna (Darién), 17 June 1963, elevation 2900 feet, GML. From *Noctilio leporinus mexicanus:* 1, Guánico (Los Santos), 13 February 1962. Non-Panamanian paratypes.—From *Artibeus cinereus:* 1, Track to Tree Station, Rio Grande Forest, Sangre Grande, TRINIDAD, 30 January 1957, T. H. G. Aitken. From *Phyllostomus hastatus:* 1, Kaiserberg Airstrip, east of Zuid River, SURINAM, 16 October 1960, elevation 900 feet, H. A. Beatty, CNHM Guianan Zoological Expedition 1960–1962. Paratypes to be deposited in the collections of Chicago Natural History Museum; United States National Museum; Trinidad Regional Virus Laboratory; Gorgas Memorial Laboratory, Panamá, Panamá; and the Environmental Health Branch at Corozal, Canal Zone.

REMARKS: We believe the primary host of this species to be *Artibeus cinereus*. Eight of the 14 lots known to us are from this host. About one-third of the specimens collected are females. Although the host records from *Artibeus, Uroderma,* and *Vampyressa* seem to be valid, we are reluctant to accept those from *Noctilio* and *Phyllostomus*. There were a number of dubious host associations in the material from Los Santos. Much of this material was collected from hosts caught in mist nets. The record from *Phyllostomus* is one of several dubious host associations in the material collected in Surinam.

Genus **Megistopoda** Macquart

Megistopoda Macquart, 1852, Ann. Soc. Ent. Fr., (2), **10**: 332. Kolenati, 1863 (*Megistopodia*, sic!), Hor. Soc. Ent. Ross., **2**: 89. Bigot, 1885, Ann. Soc. Ent. Fr., (6), **5**: 235 (as Nycteribiidae). Speiser, 1900, Arch. Naturg., **66A**, Bd. I. pp. 32, 57 (char.), 62 (cit.), 65 (keyed). Coquillet, 1900, Proc. U. S. Nat. Mus., **37**, art. 1719, p. 566. Aldrich, 1905, Smiths. Misc. Coll., **46**: 657 (as Nycteribiidae). Williston, 1906, Man. N. Am. Dipt., 3rd ed., p. 385. Speiser, 1907, Ent. News, **18**: 104 (cit.). Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, **5**: 26 (keyed), 30 (cit.). Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 13 (keyed), 28. Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 658. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479 (keyed); 1935, Amer. Mus. Novit., no. 765, p. 5 (keyed). Jobling, 1936, Parasitology, 28: 356 (status). Bequaert, 1940, Revista Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 418 (keyed); 1942, Bol. Ent. Venez., 1: 86 (keyed). Jobling, 1949, Parasitology, 39: 315. Maa, 1965, Jour. Med. Ent., 1: (4), p. 385 (synonymizes *Pterellipsis*).

Pterellipsis Coquillet, 1899, Can. Ent., 31: 333; 1910, Proc. U. S. Nat. Mus., 37, no. 1719, p. 597. Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, 5: 25 (keyed), 29 (cit.). Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 13 (keyed), 25. Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth. Wash., no. 155, p. 657. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479 (keyed); 1935, Amer. Mus. Novit., no. 765, p. 5 (keyed). Jobling, 1936, Parasitology, 28: 357 ff. (morph.). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 418 (keyed); 1942, Bol. Ent. Venez., 1: 86 (keyed). Jobling, 1949, Parasitology, 39: 321; 1952, ibidem, 42: 134, fig. 2A. Grandi, 1952, Introd. Stud. Ent., 2: 478. Hoffmann, 1953, Mem. Congr. Cient. Mex., 7: 177 (keyed), 187. [Type species: *P. aranea* Coquillet, 1899].

Type-species: *Megistopoda pilatei* Macquart, 1852.

It is remarkable that the identity of *Megistopoda pilatei* has remained unresolved since 1852, when Macquart described and figured this remarkable streblid from Mexico (Teapa). The absence of wings seemed to preclude its being identifiable with any other streblid known. Although the very sketchy illustrations showed a close resemblance to *Pterellipsis*, it was difficult to accept it as such, because of the absence of wings. Though very much reduced in *Pterellipsis*, the wings are nevertheless quite conspicuous and would hardly have been overlooked (see Speiser, 1900a). Indeed, some authors, e.g., Bigot (1885) and Kolenati (1963) placed *Megistopoda* in the family Nycteribiidae, not only because of the absence of wings, but because Macquart's figure illustrated the head as thrown back over the mesonotum, much as it is in members of that family. In *Pterellipsis*, the head is more vertical than in most other Streblidae, and the anterior portion of the mesonotum is somewhat declivious, so that with due allowances for deficiencies of Macquart's figures, these characters should not be given any serious consideration. In fact, Speiser, in describing *desiderata* (=*Pterellipsis aranea* Coquillet) assigned it to the genus *Megistopoda* and separated it from *M. pilatei* because it possessed wings.

There is always the possibility that a wingless species might yet be found that will answer Macquart's description. During the last 27 years, the senior author has identified approximately twenty or twenty-five thousand streblids from the New World tropics, including several thousand from Mexico, Guatemala and El Salvador, without finding any wingless species that would answer to the description of *M. pilatei*. However, in the Panama collection, there is a "wingless" male specimen of *Pterellipsis aranea* Coquillet from *Artibeus jamaicensis* (GML host no. 300,084), Tacarcuna (Darién), elevation 2000 feet, 20 June 1963. The wings are reduced to such minute vestiges that they cannot be detected except under very high magnifications (ca. ×150). This specimen would correspond closely to the description and figure of *Megistopoda pilatei*, and it is suggested that Macquart's type was such a wingless specimen of *Pterellipsis*. It is not at all surprising that wingless individuals would appear within a species which normally has vestigial wings. I believe it is reasonable to assume that the species *P.*

aranea Coquillet and *M. pilatei* Macquart are synonymous. *Megistopoda proxima* (Séguy) and *M. theodori* n.sp., though closely related to *aranea*, differ *inter alia* in having noticeably shorter legs. The figure of *Megistopoda pilatei* shows very long hind legs, as in *aranea*.

One can reasonably argue that the identity of *pilatei* is not settled, but we believe there is no longer any doubt concerning the identity of the genus *Megistopoda*. We agree with Maa (1965, p. 385) in considering *Pterellipsis* to be a synonym.

KEY TO THE SPECIES OF *MEGISTOPODA*

1. Wings narrow (fig. 100D). Legs very long, hind femora 1.54–1.81 mm. long, as long as or nearly as long as entire body. Prescutum with very weak setae along median suture; the lateral margins along longitudinal membranous suture, with one or two stronger setae. Hosts: *Artibeus jamaicensis, A. lituratus palmarum* ....*aranea* (Coquillet)

   Wings broader (fig. 101E). Legs shorter, hind femora 0.99–1.43 mm. long, only a little longer than abdomen. Prescutum with short but strong setae basally along median suture, the lateral margin along longitudinal membranous suture usually with four strong setae. Hosts: *Sturnira* spp. 2

2. *Male:* Gonapophyses (figs. 100C, 101D) with ventral margin nearly straight in lateral view, with a row of translucent thorn-like setae between macroseta and apex. Macroseta of right gonapophysis inserted at about basal third, that of left anterior to it. Host: *Sturnira lilium* ....*proxima* (Séguy)

   Male: Gonapophyses (fig. 100B) with ventral margin distinctly curved in lateral view; thorn-like setae few in number, restricted to lateral face and one on both dorsal and ventral margins apically; macrosetae of right gonapophysis inserted only slightly posterior to that of left, which is inserted well beyond middle. Host: *Sturnira ludovici* ....*theodori* n.sp.

Megistopoda aranea (Coquillet). Figure 100A, D.

Pterellipsis aranea Coquillet, 1899, Can. Ent., **31**: 334 (U. S. National Museum, type no. 4208); 1900, Proc. U. S. Nat. Mus., **22**: 270 (records). Speiser, 1900, Zool. Anz., **23**: 154 (synonymizes *Megistopoda desiderata* Speiser under *P. aranea.*). Aldrich, 1905, Smiths. Misc. Coll., **46**: 658. Coquillet, 1910, Proc. U. S. Nat. Mus., **37**, no. 1719, p. 597 (as type-species of *Pterellipsis*). Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, **5**: 23 (records), 30 (cit.), pl. 2, fig. 3 (wing). Wolcott, 1923, Jour. Dept. Agric. Porto Rico, **7**: 235. Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 25, pl. 2, fig. 15. Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 658. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 477 (fig.), 479 (fig., Streblidae II.–5). Jobling, 1936, Parasitology, **28**: 359 (wing structure). Cooper, 1941, Yearb., Amer. Phil. Soc., **1941**: 126 (chromosome no.). Bequaert, 1942, Bol. Ent. Venez., **1**: 88 (records). Jobling, 1949, Parasitology, **39**, pp. 316 ff., 327, fig. 2C (with *P. proxima* Séguy as syn., in error); 1952, ibidem, **42**: 134, fig. 2A. Grandi, 1952, Introd. Stud. Ent., **2**: 478. Hoffmann, 1953, Mem. Congr. Cient. Mex., **7**: 183, 187 (records), pl. 3, fig. 1.

Megistopoda aranea Maa, 1965, Jour. Med. Ent., **1**: 385.

Megistopoda desiderata Speiser, 1900, Arch. Naturg., **66A**, Bd. I, pp. 37, 42, 57–59 (descr.), 63, 65 (keyed), pl. 3, figs 6–8.

PANAMANIAN MATERIAL EXAMINED: 213 specimens in 88 lots from more than 104 bats. From *Artibeus j. jamaicensis:* 188 (76 lots) as follows: 9 (2 bats), Fort Clayton (Canal Zone), 19 and 20 October 1960; 7 (4 bats), Fort Kobbe (Canal Zone), 24 and 31 July, 12 and 27 October 1960; 16 (5 bats), Natural Bridge, Madden Dam (Canal Zone), 31 August 1959; 3, Summit (Canal Zone), 5 August 1930, L. H. Dunn No. 6 [AMNH]; 23 (4 lots), Barro Colorado Island (Canal Zone), 22 November 1956 and 3 to 12 January 1957 [USNM]; 18, Miraflores (Canal Zone), K. W. Cooper [MCZ]; 3, Arraiján (Canal Zone), 26 March 1961; 19 (7 bats), Almirante (Bocas del Toro), 23 January to 5 February 1960; 6, Isla Colón (Bocas del Toro), 18 February 1960; 4 (3 bats), Río Changena Camp (Bocas del Toro), 19 to 27 September 1961; 12 (18 bats), Cerro Hoya (Los Santos), 11 to 24 February 1962; 1, Armila (San Blas), 1 April 1963; 38 (9 bats), Punta de Piña (Darién), 23 to 24 March 1960; 5 (4 bats), Río Seteganti (Darién), 1 to 5 February 1961; 10 (4 bats), La Laguna (Darién), 9 to 17 June 1963, GML; 17 (12 bats), Tacarcuna (Darién), 20 June to 15 July 1963, GML; 3 (2 bats), Río Mono Camp (Darién), 24 and 25 July 1963.

From *Artibeus lituratus palmarum,* 4 (4 lots) as follows: 1, Fort Clayton (Canal Zone), 20 October 1960; 1, Barro Colorado Island (Canal Zone), 6 December 1956; 1, Sibube (Bocas del Toro), 25 January 1963; 1, La Laguna (Darién), 6 June 1963, 2900 feet elevation, GML. From *Carollia perspicillata azteca:* 3 (3 bats), Almirante (Bocas del Toro), 23 to 31 January 1960 (mist nets). From *Desmodus rotundus murinus:* 1, Almirante (Bocas del Toro), 25 January 1960 (mist net). From *Phyllostomus discolor:* 1, Tacarcuna (Darién), 5 September 1958. From mixed hosts (*Artibeus cinereus, A. j. jamaicensis,* and *Carollia subrufa*): 1, Río Changena Camp (Bocas del Toro). *Without host:* 3 (2 lots) Barro Colorado Island (Canal Zone), 4 November 1956, K15 and K16 [USNM].

OTHER MATERIAL EXAMINED: Numerous specimens, chiefly from *Artibeus jamaicensis,* from PUERTO RICO, MEXICO, GUATEMALA, EL SALVADOR, COSTA RICA, COLOMBIA, VENEZUELA, SURINAM, and BRAZIL.

REMARKS: This species appears to be a parasite primarily of *Artibeus jamaicensis,* though it has occasionally been taken on *Artibeus lituratus palmarum.* Records from other hosts for the most part probably represent contaminations, disturbance transfers, and errors of association, though there certainly are some that represent valid associations. *M. aranea* was taken from approximately 54.4% of all *Artibeus jamaicensis* that were parasitized by Streblidae, but on only 7.69% of *A. lituratus palmarum.* Its analogue on that host seems to be *Paratrichobius longicrus.*

Megistopoda proxima (Séguy). Figures 100C, 101.

Pterellipsis proxima Séguy, 1926, Ency. Ent., (B), II, Dipt. 3: 194–196, figs. 2–6—Argentina: "Misiones: environs de San Ignacio: Villa Lutecia," from an unidentified bat (Museum National d'Histoire Naturelle, Paris). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 658. Jobling, 1949, Parasitology, 39: 327 (as syn. of *P. aranea* Coquillet, in error); 1952, ibidem, 42: 134, 135, fig. 4B (restored to specific status).

Megistopoda proximum Maa, 1965, Jour. Med. Ent., 1: 385.

In the collection of Chicago Natural History Museum is a male specimen of *Megistopoda,* taken on *Sturnira* sp., 5 miles north of Therezopolis, Brazil. This fly appears to be identical with the species described as *proxima* by Séguy, as well as with specimens taken from *Sturnira lilium parvidens* in Panama. Although Séguy's illustration of the gonapophyses (fig. 101D) is

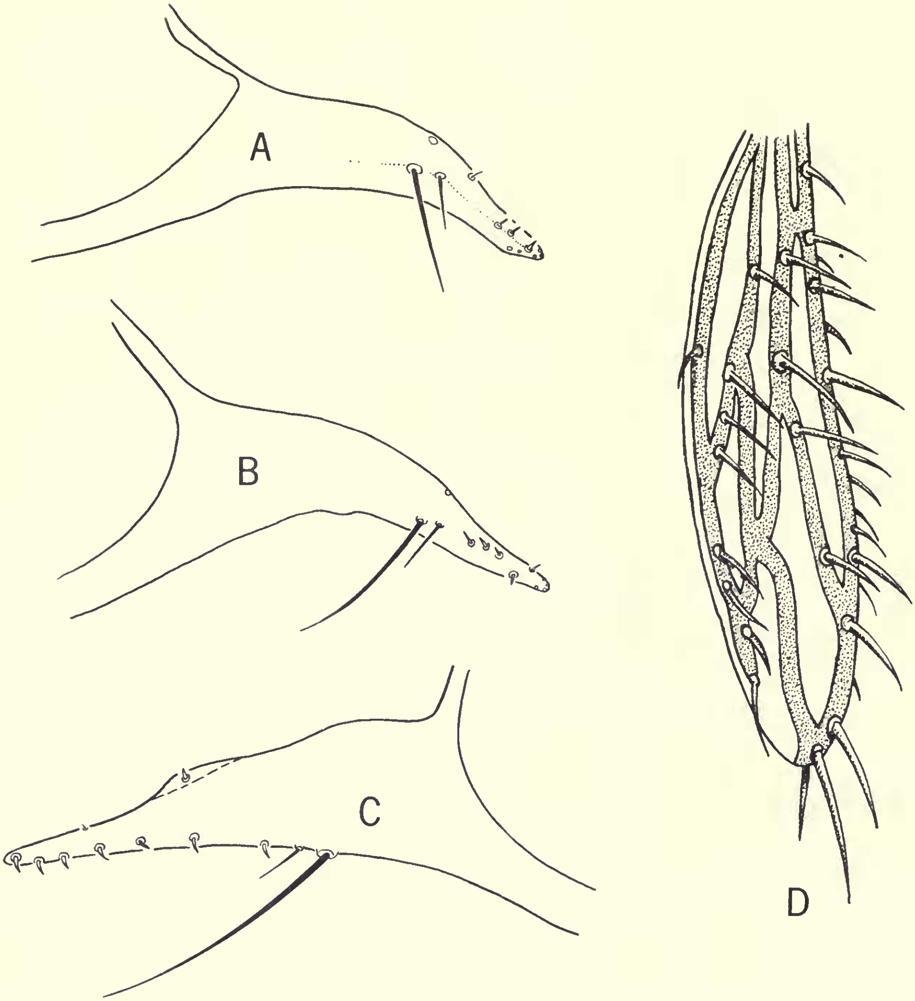

Fig. 100. A–C, left male gonapophysis of species of *Megistopoda*. A, *M. aranea* (Coquillet), from *Artibeus j. jamaicensis* (no. 6110), Piña Point (Darién). B, *M. theodori*, new species, paratype from *Sturnira ludovici* (no. 6181), Casa Tilley (Chiriquí). C, *M. proxima* (Séguy), from *Sturnira lilium* (no. 6351), Río Mandinga (San Blas). D, wing, *M. aranea* (=*desiderata* Speiser), after Speiser (1900).

made from quite a different view than ours (fig. 101C), it shows the macroseta of the right gonapophysis inserted far posteriorly, as in our specimens, and also the characteristic row of short thorn-like setae along the ventral margin. Therefore, we assign our specimens to *M. proxima.*

Measurements:	BL	TL	FL
Male	1.84–1.98	0.44–0.49	1.07–1.18
Female	1.76–2.09		0.99–1.21

PANAMANIAN MATERIAL EXAMINED: 34 species in 18 lots from (18) *Sturnira lilium parvidens* as follows: 10 (5 bats), Guánico (Los Santos), 21

January to 8 February 1962; 4 (2 bats), Cerro Hoya (Los Santos), 24 and 26 February 1962; 1, Isla Bastimentos (Bocas del Toro), 3 February 1963. 2 (2 bats), Río Tuira, 25 February 1958, P. Galindo [GML]; 1, Cerro Tacarcuna (Darién), 3 March 1964, C. O. Handley, Jr.; 3 (3 bats), Tacarcuna (Darién), 2000 feet elevation, 20 June and 7 July 1963, GML; 1, Armila (San Blas), 27 March 1963, C. O. Handley, Jr. and F. M. Greenwell; 12 (4 bats), Río Mandinga (San Blas), 26 to 30 May 1957, P. Galindo [GML].

REMARKS: This species appears to be restricted to *Sturnira lilium*, at least in Panama. We have seen a few specimens from this host, from Paraguay and Venezuela, which appear to be this species. *M. proxima* occurred on approximately 86% of the *Sturnira l. parvidens* that were parasitized by Streblidae (nearly 100%), and averaged two specimens per bat.

Megistopoda theodori Wenzel, new species. Figure 100B.

With the characters of *M. proxima* (Séguy), and apparently differing from that species only in its somewhat larger size and in the structure of the male gonapophyses (fig. 100B), which are very distinctive. In *M. proxima* (fig. 100C) both gonapophyses are very similar except that the paired ventral setae are inserted further basally on the right than on the left; the ventral margin of the gonapophyses appear nearly straight in lateral view; the paired ventral setae are inserted further posteriorly; and a row of distinct thorn-like setae (coarser than in *theodori*) is present along ventral margin. In *theodori*, the right gonapophysis is not sinuate along dorsal margin and thus appears heavier; the ventral margins are distinctly curved in lateral view, the paired ventral setae are inserted at middle or beyond; and the fine thorn-like setae are finer, fewer in number, and most are inserted on the lateral face rather than the ventral margin. *M. theodori* also differs in host and altitudinal distribution. *M. theodori* was taken on *Sturnira ludovici* together with *Trichobius brennani*, at elevations of from 4800–5600 feet, while *M. proxima* occurred on *Sturnira lilium parvidens*, together with *Aspidoptera delatorrei* n.sp., at elevations ranging from sea level to 2000 feet.

DESCRIPTION: *Head.*—Occipital lobes with eight to nine setae of varying lengths, two of them conspicuously long macrosetae. Laterovertices with about six setae. Eyes with ±7 facets. Prescutum on each side with two spiracular bristles and 15–23 others including about four strong setae along margin of longitudinal membranous cleft and posteriorly a patch of from five to seven shorter bristles along median suture. Scutum with 13–14 bristles, the anteromedian ones usually noticeably shorter than the others. Mesepimeron with 13–17 bristles in two irregular rows, the marginal ones mostly longer and coarser. *Wings.*—Broader than in *aranea*, and with venation as in *proxima* (fig. 101E). *Legs.*—As in *proxima*.

Abdomen.—Lateral lobes of tergum I+II with from 13–20 bristles, the three or four along inner dorsal margin fine, the posterior ones long and coarse, shorter ventrally. Connexivum covered with relatively short, moderately heavy bristles, these much shorter along sides, a little longer apically. Sternum I with two or three spines on each side. Sternum II subquadrate, typically with 9–14 discal setae and on posterior margin five to eight spiniform setae on each side, separated by two pairs of finer setae, the outer pair long. *Female:* Tergum VII and supra-anal plate united at middle for part of their width; VII transverse, with a conspicuous macrosetae at each side and one or two shorter ones between them; supra-anal plate with four apical macrosetae and on each side a pair of fine short setae. Connexivum with a long subapical latero-ventral macroseta. Seventh

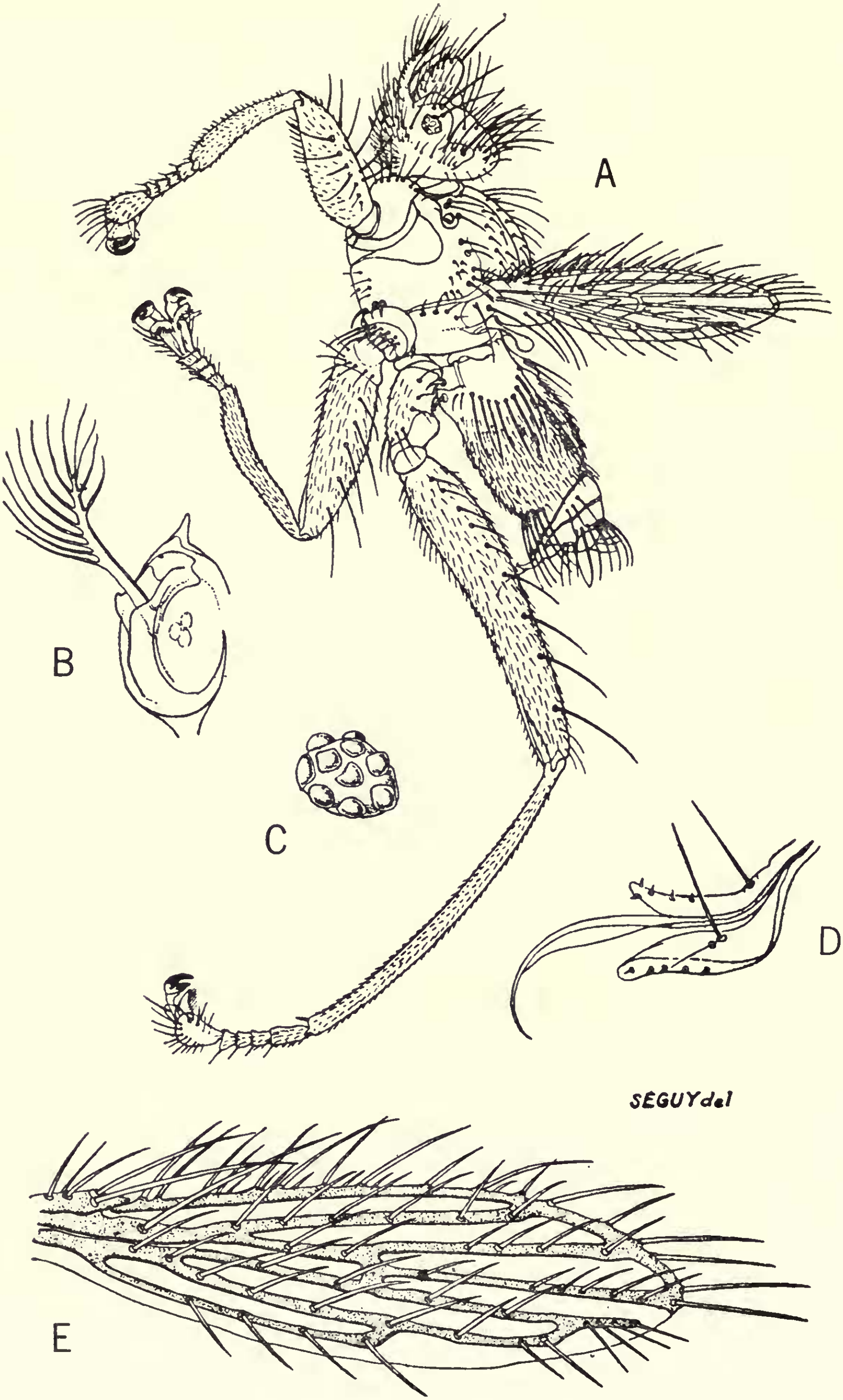

Fig. 101. *Megistopoda proxima* (Séguy). A, male, lateral view. B, antenna. C, eye. D, male gonapophyses (spread out), ventral view. E, wing. From Séguy (1926).

sternites with 11–15 setae, several of them macrosetae, one conspicuously longer than the others. *Male:* Hypopygium with two or three dorso-lateral macrosetae basally (on VII+VIII), about eight apical macrosetae and four or five latero-ventral setae on tergum IX. Sternum V with discal setae of about the same size as those of connexivum; apical margin with six to eight macrosetae, alternating with one or two shorter but strong setae, two to four shorter strong setae at middle. Gonapophyses distinctly curved in lateral view (ventral margin nearly straight in *proxima*), dorsal margin of the left gonapophysis sinuate near apex; paired ventral setae of left gonapophysis inserted distal to middle, those of right gonapophysis slightly posterior to them; right gonapophysis slightly heavier than left, without dorsal sinuation; each gonapophysis, anterior to paired ventral setae, with several extremely fine translucent, thorn-like setae along lateral face and ventral margins (one also seems to be present on dorsal margin above paired setae, though only the theca is visible in specimens examined).

Measurements:	BL	TL	FL
Male	1.98–2.16	0.49–0.52	1.13–1.43
Female	2.17–2.47	0.55	1.18–1.35

TYPE MATERIAL: Holotype male and allotype female from *Sturnira ludovici* (host no. 10469), Casa Tilley, Cerro Punta (Chiriquí), elevation 5300 feet, 14 March 1962, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—37, same data as the holotype; 7 (29 bats), same locality but 6 to 11 March 1962; 79 (26 bats), same locality, 23 April to 4 May 1960; 5 (2 bats), Lava Flow, El Hato (Chiriquí), 5 May 1960; 9 (5 bats), Casa Lewis, Cerro Punta (Chiriquí), 5600 feet elevation, 3 and 4 May 1960; 15, same locality, 1 and 2 February 1960; 9 (6 bats), Rancho Mojica (Bocas del Toro), elevation over 4800 feet, 8 and 9 September 1961; 2 (2 bats), Rancho Caballero (Bocas del Toro), elevation 6000 feet, 11 September 1961; 1, Cerro Malí (Darién), 9 February 1964, C. O. Handley, Jr.; 3 (2 bats), same locality, 4800 feet elevation, 31 May and 3 June 1963, GML; 19 (4 bats), Cerro Tacarcuna (Darién), 29 February to 7 March 1964, C. O. Handley, Jr. Paratypes to be deposited in the collections listed on p. 410.

REMARKS: We have studied *M. theodori* n. sp. and *M. proxima* (Séguy) in considerable detail, without finding any external characters that could be used for routine identification. In *theodori,* the number of mesonotal setae (excluding the spiraculars) was distinctly higher in the females (median 44) than in the males (median 38); in *proxima,* the number was only slightly higher in the females (median 33) than in the males (32). In *theodori,* the number of setae on the lateral lobes of tergum I+II ranges from 13–17 (median 14.5) in the females and 15–20 (median 16.5) in the males; in *proxima* it is nearly identical (14–19, median 17) in the two sexes. The number of setae on each of the female seventh sternites ranges from 11–16 (median 13.5) in *theodori* and from 8–17 (median 12) in *proxima.* The sample measured included about thirty of each species. There is such a broad overlap in the above ranges that, while bimodality is evident, the setal counts cannot be used for identification of individual specimens, nor for small series.

This species is named for Prof. Oskar Theodor, of the Hadassah Medical School, Hebrew University, Jerusalem, Israel, in recognition of his outstanding contributions, especially to our knowledge of the pupiparous flies and of the Phlebotominae (Psychodidae).

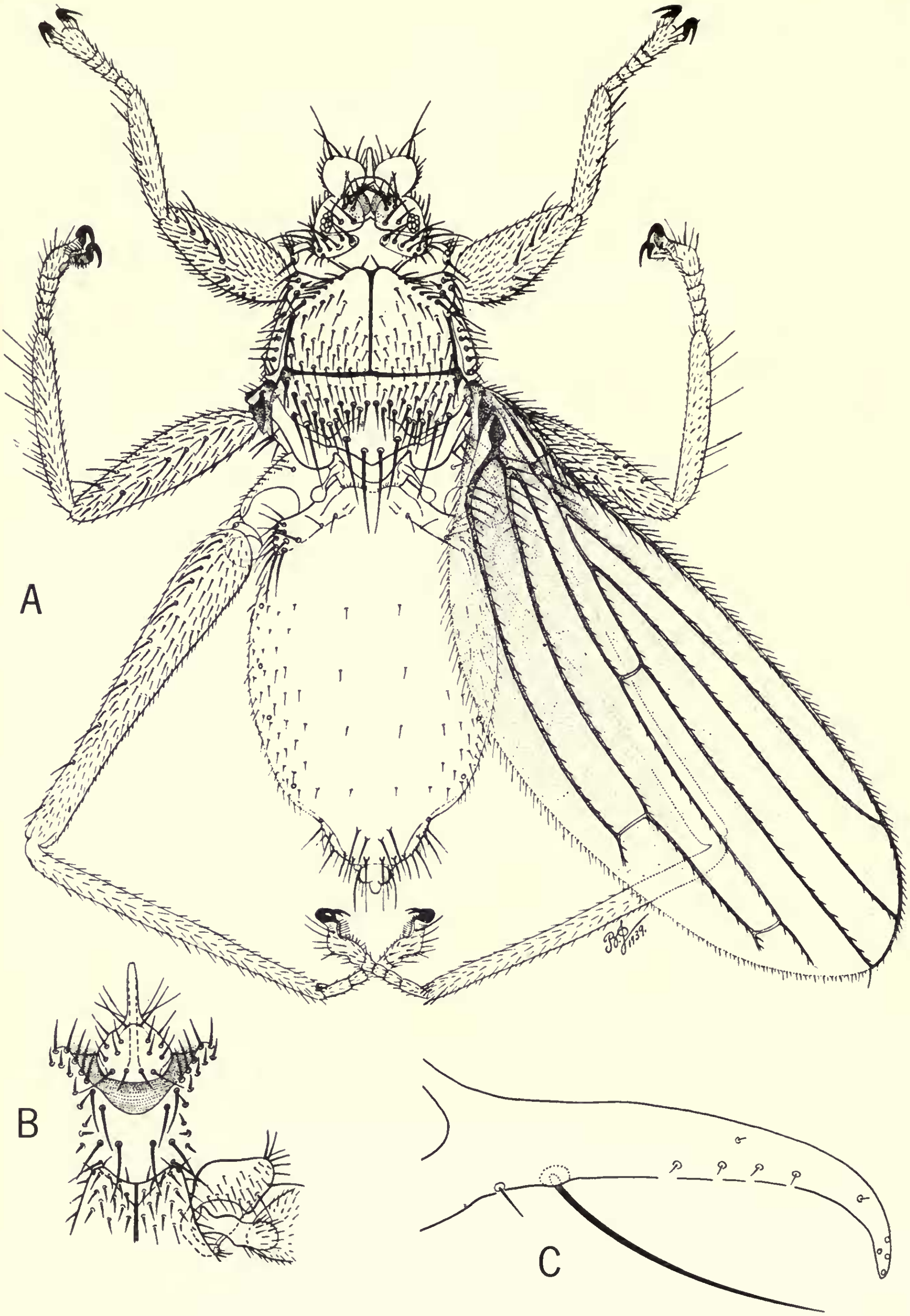

Fig. 102. *Speiseria ambigua* Kessel. A, female, dorsal view. B, posterior margin of head and anterior portion of sternopleura, ventral view. C, left male gonapophysis, specimen from *Carollia perspicillata azteca* (no. 3940), Fort Sherman (Canal Zone). A and B from Jobling (1939a).

Genus **Speiseria** Kessel

Speiseria Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 13 (keyed), 19 (diagn.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 656. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479 (keyed); 1935, Amer. Mus. Novit., no. 765, pp. 6 (keyed), 7. Jobling, 1936, Parasitology, **28**: 359 ff. (morphology). Pessôa and Guimarães, 1937, Ann. Fac. Med. São Paulo, **12**: 265. Jobling, 1939, loc. cit., **31**: 487–488 (as syn. of *Synthesiostrebla*, in error). Bequaert, 1940, Rev. Ent. Venez., **1**: 86 (keyed). Jobling, 1947, Proc. Roy. Ent. Soc. Lond., (B), **16**: 39; 1949, Parasitology, **39**: 321 (keyed). Hoffmann, 1953, Mem. Cong. Cient. Mex., **7**: 177 (keyed), 188.

Synthesiostrebla (not Townsend, 1913), Jobling, 1939, Parasitology, **31**: 487. Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., **3**: 417 (keyed). Schuurmans-Stekhoven Jr., 1951, Beitr. Fauna Perus **3**: 96 (part.).

Type-species: *Speiseria ambigua* Kessel, 1925.

The genus that was keyed out under the name *Speisseria* [*sic!*] by Curran (1934b, p. 522) was probably *Pseudostrebla* (see *S. ambigua,* below). Like the preceding three genera, *Speiseria* appears to be related to the species of the *Trichobius phyllostomae* group and is similar in the female genital characters (See *Paratrichobius*). However, the males differ from all of these in having the accessory gonapophyseal setae inserted posterior rather than anterior to the macrosetae. On the anterior face of the profemora (fig. 102) is a row of strong setae, which appear to be homologous with the spines of *Paratrichobius* and *Neotrichobius.*

Speiseria ambigua Kessel. Figure 102.

Speiseria ambigua Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 20, pl. 1 (figs. 1, 2). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 656. Curran, 1935, Amer. Mus. Novit., no. 765, p. 7. Pessôa and Guimarães, 1937, Ann. Fac. Med. São Paulo, **12**: 265, fig. 17 (in legend as fig. 16, in error). Cooper, 1941, Yearb. Amer. Phil. Soc., **1941**: 126 (chromosome no.). Bequaert, 1942, Bol. Ent. Venez., **1**: 88 (syn. notes). Jobling, 1947, Proc. Roy. Ent. Soc. Lond., (B), **16**: p. 39; 1947, Parasitology, **39**: 315 ff., 327, fig. 2B. Hoffmann, 1953, Mem. Congr. Cient. Mex., **7**: 183, 188.

Synthesiostrebla amorphochili (not Townsend, 1913), Jobling, 1939, Parasitology, **31**: 488–489. Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., **3**: 418. Schuurmans-Stekhoven, Jr., 1951, Beitr. Fauna Perus, **3**: 96 (part.).

Paratrichobius anduzei Matheson, 1945, Jour. Parasit., **31**: 191, fig. 1a–e. Jobling, 1949, Proc. Roy. Ent. Soc. Lond., (B), **18**: 144 (synonymizes *P. anduzei*).

The record of Curran (1934b, p. 523) was probably of a species of *Pseudostrebla* rather than of *Speiseria ambigua.* His specimen was from *Tonatia bidens,* host of a species of *Pseudostrebla.* To our knowledge *Speiseria ambigua* has never been taken on bats of the genus *Tonatia.*

PANAMANIAN MATERIAL EXAMINED: From *Carollia p. azteca:* 395 specimens in 139 lots, from more than 391 bats, as follows: 7 (3 bats), Camp Chágres, Madden Dam (Canal Zone), 20 to 25 June 1963, GML: 4 (2 bats), Camp Piña (Canal Zone), 11 and 26 October 1960; 2 (2 bats), bridge, Coco Solo (Canal Zone); 5 (4 bats), culvert, Gatun Tank Farm (Canal Zone), 19 November 1959; 1, culvert, Brazoa Brook, Navy Tank Farm (Canal Zone), 6 October 1959; 50 (28 bats), mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 9 September 1959 and 24 (18 bats), same locality, 25 November 1959; 1, Natural Bridge, Madden Dam (Canal Zone), 31 August

1959; 20 (12 bats), air-raid shelter, Fort Davis (Canal Zone), 6 October 1959, and 5 (6 bats), same locality and site, 29 October 1959; 1, Fort Gulick, 15 October 1959; 2 (2 lots), Battery Pratt, Fort Sherman (Canal Zone), 16 March 1960; 6, same data but 30 July 1959; 3, same data but 23 November 1959; 1, Battery Kilpatrick, same locality, 22 October 1959; and 34 (30 bats), from bats in cativo trees same locality, 2 and 4 December 1959; 6, tunnel, runway, France Field, 25 August 1959; 1, culvert, same locality, 22 September 1959; 1, magazine, same locality, 8 October 1959; 3 (3 bats), Gold Hill, same locality, 20 October 1959; 4 (34 bats), culvert, same locality, 23 November 1959, and 1 (3 bats), same locality, 30 November 1959; 27 (34 bats), Sardanillo Caves, Summit (Canal Zone), 12 August 1961, C. Yunker [RML]; 4 (2 lots), Summit, 17 April 1957, C. B. Koford [USNM]; 1, Gamboa (Canal Zone), 1 May 1957, C. B. Koford [USNM]; 1, RR culvert, Paraíso (Canal Zone), 16 September 1959; 17 (19 bats), RR culvert, east of Summit Golf Club (Canal Zone), 26 October 1959; 5, hollow tree, 1 mile from Gatuncillo (?Canal Zone), 28 July 1960; 1, culvert, Chepo Road (Panamá), 12 October 1959; 2, air-raid shelter, La Chorrera (Panamá), 18 September 1959; 9 (29 bats), Chilibrillo Caves (Panamá), 18 August 1959; 33, same locality, K. W. Cooper [MCZ]; 4, same locality, 27 August 1944 [USNM]; 5 (22 bats), Buena Vista Caves (Colón), 3 September 1959; 5 (4 bats), same locality, 15 September 1959; 32 (20 bats), same locality, 24 November 1959; 1, Porto Bello (Colón), 7 August 1923 [USNM]; 11 (10 bats), Guánico (Los Santos), 12 January to 13 February 1962; 1, Cerro Hoya (Los Santos), 25 February 1962; 9 (5 bats), Cocos Point, Isla del Rey (Darién), 22 and 24 March 1960; 2, Río Chucunaque (Darién), 19 February 1958, P. Galindo, [GML]; 5 (3 lots), Río Tuira (Darién), 25 February to 8 March 1958, P. Galindo [GML]; 1, Tacarcuna Village (Darién), 2 September 1958, P. Galindo [GML]; 32 (13 bats), Almirante (Bocas del Toro), 24 January to 1 February 1960; 2, "Panama," L. H. Dunn [MCZ]. From *Carollia castanea:* 3 (4 bats), Sibube (Bocas del Toro), 21 to 26 January 1963, C. O. Handley, Jr.; 3, Río Chucunaque (Darién), 17 February 1958, P. Galindo [GML]. From *Carollia subrufa:* 1, Río Changena Camp (Bocas del Toro), elevation 2300 feet, 21 September 1961; 1, Sibube (Bocas del Toro), 23 January 1963, C. O. Handley, Jr.; 1, Isla Bastimentos (Bocas del Toro), 3 February 1963, C. O. Handley, Jr., and F. M. Greenwell; 1, Armila (San Blas), 19 March 1963, same collectors. From *Carollia* sp.: 2, Cerro Azul (Panamá), elevation 2000 feet, 27 January 1959, E. Méndez [GML]; 1, Fort Clayton (Canal Zone), 9 January 1953, F. Blanton.

From mixed collections of *Carollia p. azteca* and *Glossophaga s. leachii:* 3, Huile (Panamá), 24 October 1960; 2, San Lorenzo Cave, Fort Sherman (Canal Zone), 15 March 1961. From *Desmodus rotundus murinus:* 5 (2 bats), Guánico (Los Santos), 26 January 1962. From *Glossophaga s. leachii:* 1, Armila (San Blas), 5 March 1963, C. O. Handley, Jr. and F. M. Greenwell; 1, Almirante (Bocas del Toro), 28 January 1960; 1, cativo trees, Fort Sherman (Canal Zone), 4 December 1959. From *Lonchophylla robusta:* 1, Buena Vista Cave (Colón), 16 June 1960. From *Lonchorhina aurita:* 1, mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 9

September 1959, and 3 (2 lots, 10 bats), same locality, 24 and 25 November 1959; 4, two miles north of Summit (Canal Zone), 17 April 1957 [USNM]. From *Natalus stramineus mexicanus:* 1, Fort San Lorenzo, Fort Sherman (Canal Zone), 17 March 1960; 1, San Lorenzo Cave (Canal Zone), 15 March 1961. From *Phyllostomus hastatus panamensis:* 1, Guánico (Los Santos), 26 January 1962; 4 (20 bats), Chilibrillo Caves (Panamá), 17 July 1959. From *Pteronotus parnellii fuscus:* 1 (3 bats), Buena Vista Cave (Colón), 3 September 1959; 2, Almirante (Bocas del Toro), 29 January 1960; 1 (4 bats), mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 25 November 1959. From *Trachops cirrhosus:* 1, culvert, Chepo Road (Panamá), 12 October 1959; 1, Battery Pratt, Fort Sherman, 23 November 1959; 1 (2 bats), Cerro Hoya (Los Santos), 15 February 1962. From *Vampyrops vittatus:* 1, Río Changena Camp (Bocas del Toro), elevation 2500 feet, 27 September 1961. *Without host:* 1, railroad culvert at tower 34–12H, Summit (Canal Zone), L. H. Dunn 181A [MCZ]; 8, Chilibrillo Caves (Panama), L. H. Dunn 277 [MCZ]; 2, same locality, no further data [CU]; 1, culvert between Miraflores and Pedro Manuel, W side of Canal (Canal Zone), L. H. Dunn [MCZ]; 2, Barro Colorado Island (Canal Zone), 2 December 1956, Koford no. 19 [USNM].

REMARKS: *Speiseria ambigua* is an unusually excitable species and leaves the host readily when disturbed.

Genus **Aspidoptera** Coquillet

Aspidoptera Coquillet, 1899, Can. Ent., 31: 334. Speiser, 1907, Ent. News, 18: 104 (synonymizes *Lepopteryx* Speiser). Williston, 1908, Man. N. Am. Dipt., 3rd ed., p. 385. Coquillet, 1910, Proc. U. S. Nat. Mus., 37, no. 1719, p. 511 (type-species). Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, 5: 25 (keyed), 28 (cit.). Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 13 (keyed), 25, 26 (char., key to spp.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 55, p. 658. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479 (keyed); 1935, Amer. Mus. Novit., no. 765, p. 5 (keyed). Jobling, 1936, Parasitology, 28: 357 ff. (morph., syst. pos.). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 418 (keyed); 1942, Bol. Ent. Venez., 1: 86 (keyed). Jobling, 1949, Proc. Roy. Ent. Soc. Lond., (B), 18: 135–144 (rev.); 1949, Parasitology, 39: 322 (keyed); 1951, Trans. Roy. Ent. Soc. Lond., **102**: 216 (morph.). Hoffmann, 1953, Mem. Cong. Cient. Mex., 7: 177 (keyed).

Lepopteryx Speiser, 1900, Arch. Naturg., **66A**, Bd. I, pp. 42, 53 (diagn.), 62, 65 (keyed). [Type-species: *Lipoptena phyllostomatis* Perty].

Lipoptena (not Nitsch, 1818), Kolenati, 1863, Hor. Soc. Ent. Ross., 2: 103 (keyed). Bigot, 1885, Ann. Soc. Ent. Fr., (6), 5: 226 (part).

Type-species: *Aspidoptera busckii* Coquillet, 1899.

Jobling (1949a) recognized four species of *Aspidoptera,* namely, *megastigma* Speiser, *minuta* Costa Lima, *clovisi* Pessôa and Guimarães, and *phyllostomatis* (Perty). It has long been apparent to the senior author that these were convergent types representing the independent evolution of small size and reduced wings. We have re-assigned the first three to new genera, *Mastoptera, Exastinion,* and *Noctiliostrebla,* respectively. Only one of these (*Exastinion*) appears to be monotypic.

As restricted by us, *Aspidoptera* now includes those minute brachypterous species with the following characters:

DIAGNOSIS: *Head.*—Laterovertices and occipital plates well differentiated. Laterovertices without a longitudinal or oblique dark suture; occipital plates rounded posteriorly, without a posterior lobe or flap. *Thorax.*—With a complete median suture which is united with the transverse mesonotal suture. Longitudinal and vertical membranous clefts open. Sternopleura not strongly produced anteriorly, sides oblique. Pleurotrochantines with a blunt reflexed median lobe, this not united with the metepimeron. *Legs.*—Subequal. *Wings.*—Brachypterous but with essentially complete venation. *Abdomen.*—Tergum I+II and sternum II without any distinctive characters. *Female:* Tergum

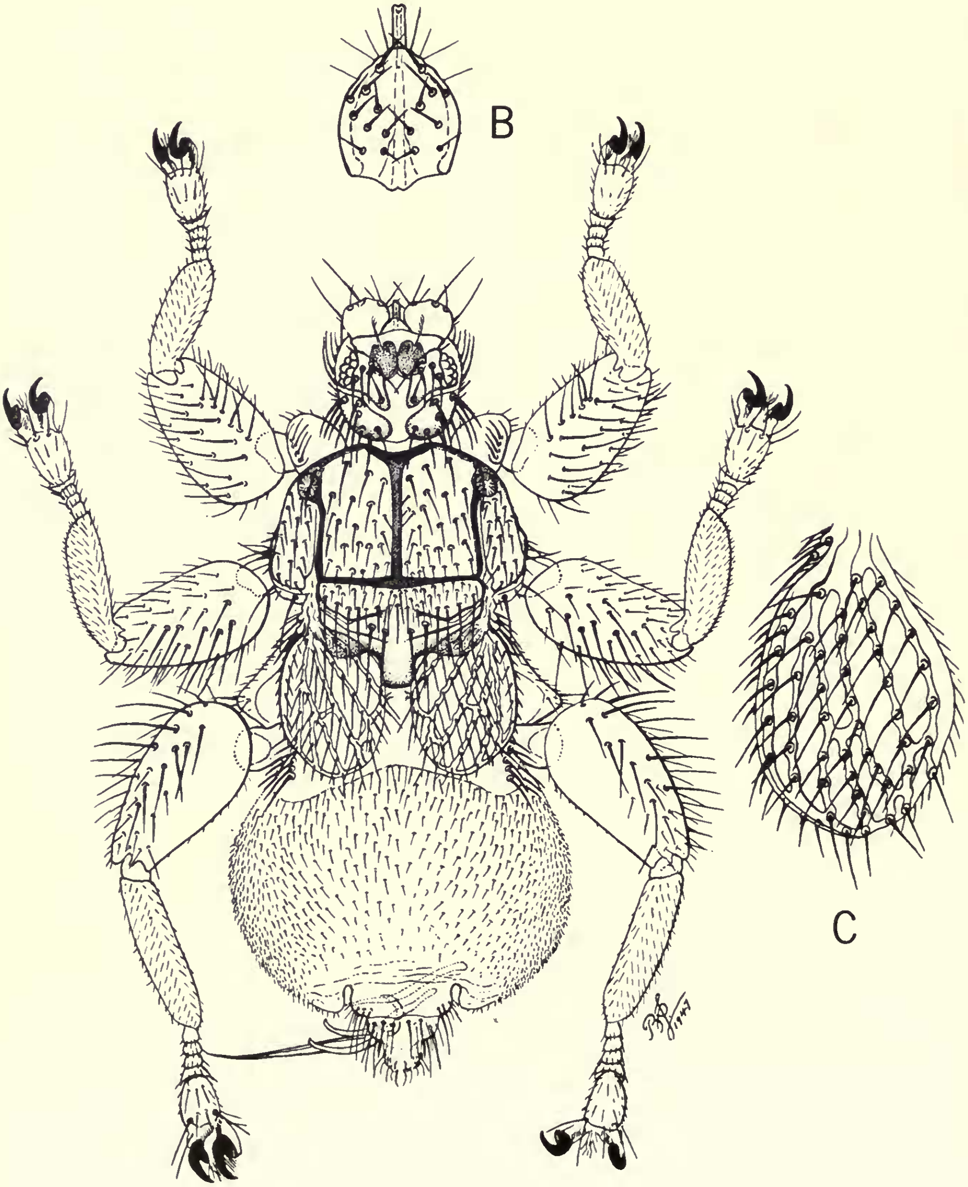

Fig. 103. *Aspidoptera phyllostomatis* (Perty). A, male, dorsal view. B, labium. C, wing. From Jobling (1949a).

VII very weakly sclerotized, with a transverse row of two to four short setae. Supra-anal plate short. Seventh sternites small. Cerci free, not united with ventral arc. *Male:* Sterna V and VI absent. Gonapophyses curved laterally and downwardly at apex; accessory seta inserted posterior to the macroseta.

We tentatively segregate four species of *Aspidoptera: busckii* Coquillet, *phyllostomatis* (Perty) (*sensu* Jobling 1949a), *delatorrei* n. sp., and an undescribed species from Brazil. Two of these are known to us from Panama.

Aspidoptera phyllostomatis (Perty). Figures 103, 104E.

Lipoptena phyllostomatis Perty, 1833(?), Delect. Anim. Artic., fasic. 3, p. 190, pl. 37, fig. 16—"in Phyllostomatis specie brasiliensis, indeterminata" (type apparently lost). Westwood, 1840, Introd. Mod. Class. Ins., 2: 585. Kolenati, 1856, Parasiten d. Chiropteren, p. 48, pl. 4, fig. 48a, b; 1863, Hor. Soc. Ent. Ross, 2: 98 (notes), 103 (keyed).

Leptotena phyllostomatis Macquart, 1835, Hist. Nat. Ins. Dipt., 2: 645.

Lepopteryx phyllostomatis Speiser, 1900 (part., female), Arch. Naturg., 66A, Bd. I, pp. 32, 53–54 (descr.), 62, 65 (keyed), pl. 3, figs. 3, 4.

Aspidoptera phyllostomatis Speiser, 1900 (part.), Zool. Anz., 23: 153 (synonymizes *A. busckii* Coquillet). Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, 5: 20 (discuss.), 22 (keyed), 28 (cit.), pl. 1, fig. 4 (wing). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 658. Jobling, 1936, Parasitology, 28: 359 (wing struct.); 1949, ibidem, 39: 315 ff., fig. 1G; 1949, Proc. Roy. Ent. Soc. Lond., (B), 18: 136 (keyed), 137 (redescr.), fig. 1 (with *busckii* Coq. as synonym).

The type of *Lipoptena phyllostomatis* Perty, 1833, is apparently lost. Presumably, it was deposited in the Munich Museum (Zoologische Sammlung des Bayerischen Staates) along with the other insects Perty described from the material collected in Brazil by Spix and Martius. Speiser (1900a, p. 53) inquired about the type and was told that it was lost. Dr. T. C. Maa (pers. comm.) has informed us that he saw nothing in European collections that could be regarded as the type, though he had not studied either the collection at Munich or the Perty collection at the Natural History Museum in Bern.

At our request, Dr. W. Forster of the Munich Museum has kindly searched for the type again without success. He wrote (pers. comm.):

> "Leider wurde in früheren Zeiten das nicht als solches bezeichnete Typen-Material teilweise in der Schausammlung gezeigt, sodass auf diesem Wege manche Verluste eingetreten sind. Auch ein erheblicher Teil der Perty'schen Typen ging damals zugrunde. Ich glaube also, Sie können, falls nötig, es ohne weiteres verantworten einer Neotypus aufzustellen und zu publizieren."

Dr. H. D. Volkart, Curator of Invertebrates at the Natural History Museum at Bern searched for the type in the collection of that institution without success. He wrote:

> "Der Typus von *Lipoptena phyllostomatis* Perty befindet sich leider nicht in unseren Sammlungen. Wohl ist die Sammlung Perty hier im Museum, aber sie kamseinerseit leider in schlecht erhaltenem Zustand hierher und ist heute nicht mehr vollständig. Es ist daher nicht mehr möglich, festzustellen, ob sich der Typus von *phyllostomatis* in Perty's persönlicher Sammlung befand; wir besitzen heute kein Exemplar dieser Art."

We agree with Dr. Forster that a neotype should be established. Unfortunately, there is little basis for interpreting Perty's *phyllostomatis*.

The type locality is Brazil, the type host "in phyllostomatis specie brasiliensis indeterminata." The name *Phyllostomus* was applied to many bats of the family Phyllostomidae even until the early Twentieth Century. Bats of the genus *Phyllostomus* are parasitized by *Mastoptera minuta* (Costa Lima) in Brazil (see "Remarks," p. 516). However, Perty's illustration, poor as it is, could hardly be of that species, but rather of a fly more nearly like that interpreted as *phyllostomatis* by both Speiser (1900) and Jobling (1949a). We follow Jobling's interpretation of *phyllostomatis*.

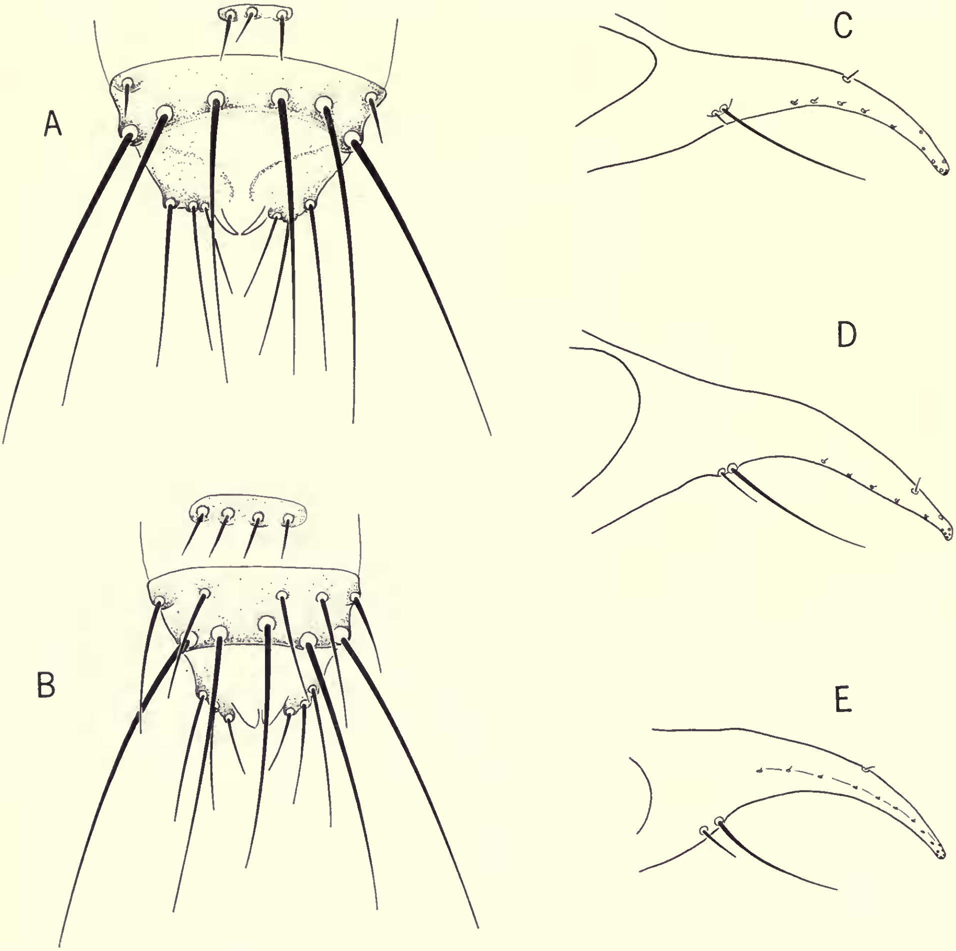

Fig. 104. A, B, terminal cone, abdomen, female. A, *Aspidoptera busckii* Coquillet, from *Artibeus l. palmarum* (no. 9959) Cerro Hoya (Los Santos). B, *A. delatorrei*, new species, allotype. C–E, left male gonapophysis. C, *A. busckii* Coquillet, from *Artibeus j. jamaicensis* (5512), Almirante (Bocas del Toro). D, *A. delatorrei*, new species, holotype. E, *A. phyllostomatis* (Perty), from "*Phyllostoma*" sp., Humboldt, (Santa Catharina), BRAZIL.

Jobling's description and figure are based on a slide-mounted specimen collected from *Phyllostomus* sp. at Humboldt, Sta. Catharina, Brazil, by Ehrhardt. The host was obviously not a *Phyllostomus*. Jobling's specimen was from one of several lots, apparently collected by Ehrhardt from the same host species, which contained *Trichobius phyllostomae* Kessel (including the holotype) and a species of *Megistopoda,* as well as the *Aspidoptera.* This assemblage indicates that the host was either an *Artibeus* or a species of *Sturnira.* A specimen of *T. phyllostomae* in the collection of Chicago Natural History Museum was taken from "*Artibeus literatus jamaicensis*" at Joinville (Santa Catharina). A new species of the *phyllostomae* group but more closely related to *brennani* n.sp. (from *Sturnira ludovici*) than to *phyllostomae* was taken from *Sturnira* sp. at Therezopolis, BRAZIL, with a species of *Aspidoptera* that is related to *delatorrei* n.sp. (from *Sturnira lilium*), rather than to *phyllostomatis, sensu* Jobling. It seems likely, then, that the host of Jobling's *phyllostomatis* was an *Artibeus.*

We designate as the neotype of *phyllostomatis* the specimen (noted above) upon which Jobling based his description and illustration, in the collection of the British Museum (Natural History). We have seen an additional specimen, from the same host and locality, which was kindly sent to us by Dr. Harold Oldroyd of that museum.

Jobling's figure (fig. 103) indicates that the dorsal surface of the mesepisterna have uniform, rather short setae, but in the Humboldt specimen before us, the outer (lower) setae are short and the inner (upper) setae are long. When specimens are studied and illustrated from slide preparations, the apparent length of the setae is often deceptive because of foreshortening.

As noted by Maa (1963), Westwood (1840, vol. 1, p. 585) refers *Lipoptena phyllostomatis* to Nitzsch ("Voyage Prince Maximilian of Bavaria") as well as to Perty. We have been unable to find the Nitzsch reference in any bibliographic sources, and thus cannot determine whether or not his use of the name antedates that of Perty.

Aspidoptera busckii Coquillet. Figure 104A, C.

Aspidoptera buskii Coquillet, 1899, Can. Ent., **31**: 335—"Bayamon, Porto Rico," from *Artibeus* sp. (U. S. National Museum, no. 4210); 1900, Proc. U. S. Nat. Mus., **22**: 270 (record). Aldrich, 1905, Smiths. Misc. Coll., **46**: 657. Coquillet, 1910, Proc. U. S. Nat. Mus., 37, no. 1719, p. 511 (as type-species of *Aspidoptera*). Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, **5**: 22 (status), 28 (cit.). Wolcott, 1923, Jour. Dept. Agric. Porto Rico, **7**: 235. Kessel, 1925, Jour. N. Y. Ent. Soc., **33**:26. Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 658. Jobling, 1936, Parasitology, **28**: 359 (wing characters); 1949, Parasitology, **39**: 315 (syn. note). Cooper, 1941, Yearb. Amer. Phil. Soc., **1941**: 126 (chromosome no.). Grandi, 1952, Introduz. Stud. Ent., **2**: fig. 439.

Lepopteryx phyllostomatis (not Perty, 1833), Speiser, 1900 (part.,), Arch. Naturg. **66A**, Bd. I, pp. 32, 53 (keyed), pl. 3, fig. 3.

Aspidoptera phyllostomatis Speiser, 1900 (part.), Zool. Anz., **23**: 153 (with *busckii* as synonym); 1907, Ent. News, **18**: 104. Jobling, 1949, Proc. Roy. Ent. Soc. Lond., (B), **18**: 138 (part., Antillean records only).

The name *busckii* is revived for the species of *Aspidoptera* that parasitizes *Artibeus jamaicensis* and *A. lituratus* as well as bats of some closely related genera, in the West Indies, Central America, and northwestern South America. We are unable at this time to give characters that will separate females of *phyllostomatis* and *busckii.* The males appear to be distinct in the structure of the gonapophyses (fig. 104C, E). The specimens recorded below from *Vampyressa* and *Chiroderma* appear to be the same species as from *Artibeus jamaicensis* and *A. lituratus.* Specimens from Panama seem to be identical with those on *Artibeus jamaicensis* in the West Indies. This is interesting, because *Artibeus jamaicensis parvipes* (Greater Antilles) and *A. j. yucatanicus* (in Mexico, Guatemala) are parasitized by an undescribed species of *Trichobius,* while *Artibeus j. jamaicensis* in Panama is not. A few additional characters that apply to both *busckii* and *phyllostomatis,* not included in Jobling's description, follow.

A heavily pigmented species. *Head.*—Ventral face of palpi with sparse setae on a little more than basal half. Postgenae with a row of rather heavy setae dorsal and parallel to ventral margin of oral cavity, dorsal to these, a row of very short setae. *Thorax.*—Spiracles large. Sutures heavy, transverse suture nearly straight. Mesepisterna dorsally with several rows of setae, the outer ones conspicuously shorter.

Abdomen.—Lateral lobes of tergum I+II with two longitudinal rows of about six heavy long bristles each, the most posterior ones of the inner (marginal) row shorter; ventral to these a group of seven to nine shorter bristles. *Female:* Supra-anal plate with six apical or subapical macrosetae and on each side near mid-length a short submarginal bristle. Seventh sternites small, roundly oval, with nine to ten setae. *Male:* Gonapophyses as shown in fig. 104C.

Measurements:	BL	TL
Male	1.85–2.03	0.56–0.60
Female	2.03–2.25	0.60–0.63

PANAMANIAN MATERIAL EXAMINED: From *Artibeus j. jamaicensis:* 34 (32 bats), Almirante (Bocas del Toro), 22 January, 18 February 1960; 17, Rio del Puente, Natural Bridge, Madden Dam (Canal Zone), 31 August 1959; 1, same locality, 5 April 1933, L. H. Dunn no. 25 [AMNH]; 1, cave, west side of Taboga Island (Panamá), 24 September 1959; 20 (8 bats), Piña Point (Darién), 24 March 1960; 6 (3 bats), Río Setegantí (Darién), 4–5 February 1961, P. Galindo [GML]; 3 (1 bat), Río Tuira (Darién), 10 March 1958, P. Galindo [GML]; 13 (11 bats), La Laguna (Darién), 2900 feet elevation, 2–15 June 1963; 21 (12 bats), Tacarcuna (Darién), 2000 feet elevation, 20 June to 12 July 1963, GML; 14 (9 bats), Cerro Hoya (Los Santos), 8 to 16 February 1962; 1, Guánico (Los Santos), 12 January 1962. From *Artibeus lituratus palmarum:* 1, Summit (Canal Zone), K. W. Cooper [MCZ]. 3 (3 lots), Barro Colorado Island (Canal Zone), 1 lot each, 4 November 1956, 6 December 1956, and 3 January 1957 [USNM]; 1, Cerro Hoya (Los Santos), 21 February 1962; 1, Río Mandinga (San Blas), 15 May 1957, P. Galindo [GML]. From *Chiroderma villosum jesupi:* 1, Almirante (Bocas del Toro), 24 January 1960. From *Vampyressa nymphaea:* 4 (1 bat), Río Mono Camp (Darién) 25 July 1963, GML. From *Carollia p. azteca* (mist net): 2, Almirante (Bocas del Toro), 26 and 31 January 1960. From *Phyllostomus discolor* (mist net): 1, Almirante (Bocas del Toro), 30 January 1960.

NON-PANAMANIAN MATERIAL EXAMINED: From *Artibeus jamaicensis parvipes:* 1, CUBA, Dethier [MCZ]. From *Artibeus jamaicensis:* about a dozen lots from various localities in MEXICO, GUATEMALA and COLOMBIA.

REMARKS: We have seen numerous specimens that are either *busckii* or *phyllostomatis* from Venezuela and Peru. We have not studied them sufficiently to identify them at this time.

Aspidoptera delatorrei Wenzel, new species. Figure 104B, D.

Similar to *A. phyllostomatis* (Perty), and *busckii* Coquillet but differing from both in that the bristles of all rows on the dorsal surface of the mesepisterna are long (setae of outer rows short in *busckii* and *phyllostomatis*); the supra-anal plate (female) has a transverse row of four to six shorter setae across middle (fig. 104B), rather than only one on each side, in addition to the apical macrosetae; and the short dorsal bristle of the male gonapophyses is inserted near apex rather than near middle.

DESCRIPTION: Smaller, more lightly pigmented, and on the whole more densely setose than *busckii* Coquillet and *phyllostomatis* (Perty). *Head.*—Ventral surface of palpi with numerous short setae distributed from base nearly to apex. Genae densely setose, bristles along dorsal margin long, gradually shorter ventrad; postgenae with bristles along margin of oral cavity; parallel and dorsal to these are two or three rows of subequal bristles. *Thorax.*—Spiracles small. Transverse suture distinctly sinuate on each side. Dorsal surface of mesepisterna with three longitudinal rows of long subequal bristles.

Abdomen.—Tergum I+II with 23–24 bristles arranged in three or four irregular longitudinal rows, most of the bristles long, but the most anterior bristle of upper row short, as are two or three ventral ones. *Female:* Tergum VII very small, feebly sclerotized and indistinct, typically with four, sometimes three, bristles. Supra-anal plate usually with six (rarely, four or five) apical or subapical macrosetae and anterior to these, a transverse row of five or six shorter setae; the latter often divided into two lateral groups by the foreward displacement of the median pair of subapical macrosetae.

Measurements:	BL	TL
Male	1.65–1.90	0.48–0.49
Female	1.70–2.36	0.49

TYPE MATERIAL (from *Sturnira lilium parvidens*): Holotype male and allotype female (slides, host no. 9406), Guánico (Los Santos), 13 February 1962, C.M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum. Paratypes.—1, same data as holotypes; 3, same locality but 8 February 1962; 3 (2 bats), Río Tuira (Darién), 25 February and 10 March 1958, P. Galindo [GML]; 5 (2 bats), Río Mandinga (San Blas), 26 and 27 May 1957, P. Galindo [GML]. Non-Panamanian paratypes.—3, Finca El Zapote, Zapote (Escuintla), GUATEMALA, 2400 feet elevation, 14 July 1948, R. D. Mitchell and Luis de la Torre, CNHM Guatemala Zoological Expedition (1948); 2, La Catarina, 2 miles north of Ciudad Guzman (Jalisco), MEXICO, 9 December 1954, L. de la Torre, CNHM Mexican Zoological Field Trip (1954). Paratypes in the collections of Chicago Natural History Museum; the United States National Museum; Gorgas Memorial Laboratory, Panamá, Panamá; Environmental Health Branch (U. S. Army) at Corozal (Canal Zone); Departmento de Zoologia, Secretaria da Agricultura, São Paulo, Brazil; Faculdad de Ciencias, Universidad Central de Venezuela; and Bernice P. Bishop Museum, Honolulu.

OTHER MATERIAL EXAMINED: From *Carollia p. azteca:* 1, Río Tuira (Darién), 5 March 1958, P. Galindo [GML].

REMARKS: This species is named for Dr. Luis de la Torre, College of Pharmacy, University of Illinois, Chicago. Dr. de la Torre has added much to our knowledge of ectoparasites of mammals, especially bats, through his collecting in Mexico and Guatemala.

KEY TO THE PANAMANIAN SPECIES OF *ASPIDOPTERA*

All dorsal setae of mesepisterna long. Tergum I+II with three or four rows of conspicuous, long bristles, in addition to the short bristles present near inner anterior margin and ventrally. *Female:* Supra-anal plate (fig. 104B) with five or six very long apical or subapical setae and a transverse row of six shorter setae across middle, this row sometimes separated into two lateral groups of three setae each by an anterior displacement of the median pair of macrosetae. *Male:* Gonapophyses as in fig. 104D. . . . . *delatorrei* n. sp.

Outer setae of dorsal surface of mesepisterna short. Tergum I+II with only two rows of long bristles, in addition to a group of short ventral bristles. *Female:* Supra-anal plate (fig. 104A) with five or six apical macrosetae and, on each side near mid-length, a short submarginal seta. *Male:* Gonapophyses as in fig. 104C. . . . . *busckii* Coquillet

Exastinion Wenzel, new genus

Type-species: *Aspidoptera clovisi* Pessôa and Guimarães, 1936.

Resembling *Aspidoptera* but differing conspicuously in several characters: each occipital lobe is produced as an oblique flap (fig. 105C), with crenated inner margin (posterior margin of head rounded in *Aspidoptera*); the longitudinal and vertical membranous thoracic clefts are closed, the line of fusion marked by dark pigmented sutures; the median mesonotal suture is bifurcate anteriorly; the dorsal abdominal connexivum is bare except toward sides; and sternum V is present in the male.

DIAGNOSIS: Minute species, 1.2–1.8 mm. long. *Head.*—Flattened. Theca cordiform. Palpi roughly oval, slightly longer than wide, anterior margins obliquely truncated, with setae along margins, and on ventral surface with fine setae on slightly more than basal half, the upper surface microsetose. Laterovertices and occipital plates differentiated, both microsetose, setae on laterovertices restricted to antero-lateral portions, laterovertices each with a long, posteriorly directed process, oblique occipital plates with a feebly sclerotized, posteriorly directed flap on each side, their posterior margins pigmented, crenated, with long bristles, and overlapping the anterior portion of the prescutum. Mediovertex unsclerotized, projecting downward as a minute process between the occipital flaps. Genae with long setae along dorsal margin, but ventral to these are numerous, shorter, thorn-like setae. Postgenae, below, with a large oval, lightly sclerotized transverse area on each side of the oral cavity. Eyes minute, indistinctly faceted, with four to six facets.

Thorax.—Mesonotum flat; median suture of prescutum bifurcate anteriorly, united posteriorly with the sinuate transverse suture; scutum very short, less than a third as long as prescutum. Mesipisterna prominent and flattened above, longitudinal and vertical membranous clefts closed, represented by rigid, pigmented sutures. Sternopleura broadly projecting and emarginate between the procoxae. Posterior margin of pleurotrochantines with a median, rounded, slightly reflexed lobe. *Wings.*—Brachypterous, with venation essentially normal, except that second and third crossveins are absent. *Legs.*—Short, subequal, femora stout, femora and tibiae subequal in length, clothed with long setae on antero-dorsal surface of fore- and midlegs, and on dorsal surface of hindlegs, the setae elsewhere shorter to very short. Tarsi short, tarsomeres 1–4 progressively wider and more strongly anteroposteriorly compressed, the fourth nearly as wide as the fifth, the latter broad, posteriorly rounded; claws large.

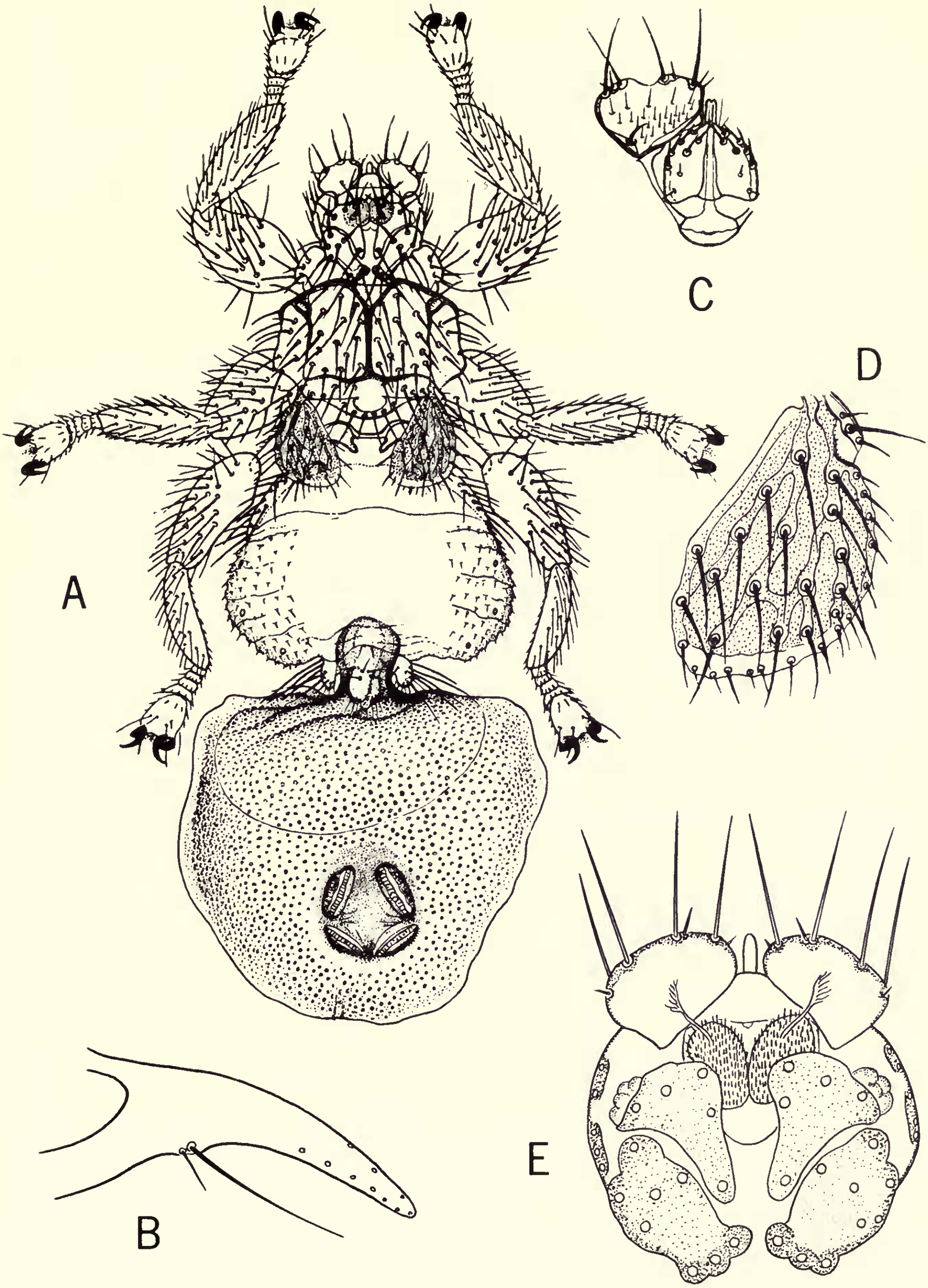

Fig. 105. *Exastinion clovisi* (Pessôa and Guimarães). A, female, with pupa extruding, dorsal view. B, left male gonapophysis, specimen from *Anoura cultrata* (no. 8593), Río Changena Camp (Bocas del Toro). C, head, dorsal view (setae of laterovertices and occipital lobes omitted). D, wing. E, mouthparts. A, D, and E from Jobling (1949a), based on specimen from *Anoura g. geoffroyi*, Aripa Cave, TRINIDAD.

Abdomen.—Dorsal connexivum bare except toward sides; paired dorsal segmental setae absent; sides and venter with fine, short setae. Tergum I+II very short at middle, with conspicuous, posteriorly directed lateral lobes. Sternum II well developed, setose in a median triangular area and along posterior margin, the setae borne in minute thecae, these, in turn, on a translucent plaque. *Female:* Tergum VII a small, feebly sclerotized, translucent, transverse plate, bearing two short setae. Supra-anal plate very short, transverse. Seventh sternites short and transverse. Cerci free, not united with the ventral arc. *Male:* Sternum V very short and broad; VI not distinguishable as a sclerite, though it seems to be represented by a thread-like, translucent band. Hypopygium very short. Gonapophyses as in *Trichobius.*

The name of the genus is derived from the Greek *exastis* (rough edge or fringe) + *inion* (back of head, occiput).

Exastinion clovisi (Pessôa and Guimarães), *new combination.* Figure 105.

Aspidoptera clovisi Pessôa and Guimarães, 1936, Ann. Fac. Med. São Paulo, 12, fasc. 2, pp. 262–263, figs. 5–6—Ipiranga, São Paulo, Brazil, from *Anoura geoffroyi* (?Laboratorio de Parasitología, Faculdade de Medicina, Universidad de São Paulo); 1940, Arq. Inst. Biol., São Paulo, 11: 424, fig. 1. Guimarães, 1944, Papeis Avulsos, São Paulo, 6: 187, figs. 10–14 (descr. of "larva"). Jobling, 1949, Proc. Roy. Ent. Soc. Lond., (B), 18: 138 (redescr.), 136 (keyed), fig. 2; 1949, Parasitology, 39: 316 ff. (hosts), 327 (records), fig. 1J; 1951, Trans. Roy. Ent. Soc., Lond., 102: 216. Hoffmann, 1953, Mem. Congr. Cient. Mex., 7: 183, 188 (records).

Aspidoptera phyllostomatis (not Perty, 1833), Bequaert, 1940, Rev. Acad. Colomb. Cienc. Ex., Fis. y Nat., 3: 418. Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 26 (part.).

PANAMANIAN MATERIAL EXAMINED: 53 specimens (9 lots) from 11 bats at localities from 2500–5300 feet. From *Anoura geoffroyi lasiopyga:* 4 (2 bats), Rancho Mojica (Bocas del Toro), 12 September 1961; 7 (3 bats), Casa Lewis, Cerro Punta (Chiriquí), 1 to 5 February 1960, and 1, same locality, 4 May 1960; 11 (2 bats), Cerro Hoya (Los Santos), 11 February 1962. From *Anoura cultrata:* 3 (1 bat), Cerro Punta (Chiriquí), 12 March 1962; 18 (2 bats), Río Changena Camp (Bocas del Toro), 27 September 1961.

OTHER MATERIAL EXAMINED: We have examined about 175 other specimens from *Anoura aculeata* (VENEZUELA) and from subspecies of *Anoura geoffroyi* from TRINIDAD, VENEZUELA, COLOMBIA, ECUADOR and GUATEMALA.

REMARKS: Jobling (1949a, p. 138, fig. 2B) indicated that the eyes of *A. clovisi* were not faceted and so figured one. All of our specimens show five to six minute facets in slide preparations (fig. 105C). The palpus figured by Jobling (fig. 105E) is lying in an oblique plane and appears to be transverse. Actually, the palpi are very slightly longer than broad. The setae on sternum II are quite uniform in size in the male, though one or two at each postero-lateral angle may be a little longer. In the female there is a group of conspicuously longer setae within these angles.

This may be a composite species, but to date we have not been able to distinguish between specimens from different species of *Anoura* or from different geographic areas.

Noctiliostrebla Wenzel, new genus

Type-species: *Lipoptena dubia* Rudow, 1871.

Superficially resembling species of *Aspidoptera, Exastinion, Mastoptera,* and *Paradyschiria* but not closely related to any of these. Easily separated from them by the characters given in the key and distinctive in the following: longitudinal and vertical membranous clefts closed, the mesepisternum and prescutum, and the mesepisternum and mesepimeron completely fused without evidence of a suture (!); tergum VII of female represented by paired transverse sclerites; male gonapophyses "free" anteriorly, articulated ventrally by short processes to forks of the gonapophyseal apodeme; sterna V and VI absent in male; hind tibiae along inner apices with a mixture of normal setae and extremely fine, translucent, flattened setae, the latter so closely placed as to appear to be branched when examined under low magnifications.

DIAGNOSIS: Small louse-like species. *Head.*—Nearly round, viewed from above; elevated posteriorly, viewed in profile; with well-defined laterovertices and occipital lobes, each laterovertex divided by an oblique, dark suture. Palpi irregularly rounded, with marginal setae only, ventral surface lacking setae. Theca subcordiform.

Thorax.—Anterior margin of prescutum feebly emarginate but slightly projecting at middle; median suture strong, complete, united with the transverse suture, to form an inverted "Y". Spiracular openings large, doughnut-shaped, very conspicuous. Prescutum without discal setae, the setae restricted to sides and anterior margin. Longitudinal and vertical membranous clefts absent, the prescutum and pleura completely fused, without evidence of a suture. Dorsal and ventral surfaces of thorax often with conspicuous irregular lighter areas in the cuticle. *Wings.*—Very short, oval, pointed, with marginal bristles, veins indistinct, very much reduced in number, usually three, sometimes four. *Legs.*—Short, subequal. Tibial setae sparse, arranged in rows; dense setae along inner margin of metatibiae on about distal fifth, a mixture of normal setae, and extremely fine flattened setae, which in profile appear almost filamentous under oil immersion. Tarsi stout, about three-fourths as long as tibiae; tarsomeres 1–4 antero-posteriorly compressed, the last tarsomere with subparallel sides, about as long as 1–4 combined; claws large, conspicuous.

Abdomen.—Spiracles much smaller than thoracic spiracles but conspicuous and "doughnut-shaped." Abdominal connexivum transversely wrinkled, the setae relatively short and borne on feebly sclerotized plaques. Tergum I+II very well developed, emarginate at middle. *Female:* Tergum VII represented by a pair of transverse sclerites. Supra-anal plate short. Ventral arc about the same size as supra-anal plate, the two forming an annulus. Cerci free, not united with ventral arc. *Male:* Hypopygium greatly developed, conspicuous, obconical. Sterna V and VI absent. Gonapophyses short and blade-like, free and separate, not arising from a gonapophyseal sheath but each articulated ventrally by a process to the forked gonapophyseal apodeme and posteriorly to the recurved base of the aedeagus; aedeagus strongly laterally compressed, blade-like in lateral profile, its posterior end curved, but not coiled.

The species of *Noctiliostrebla* and *Paradyschiria* do not appear to be at all closely related, but the presence in both genera of the peculiar, heavy, transversely wrinkled abdominal connexivum (with setae borne on conspicuous plaques) and the conspicuous spiracles, suggest that these characters are of adaptive value to parasites of the fish-eating bats. One might speculate that they are concerned with water regulation. The bats not only scull the water surface for food, but it is known that, at least in the case of *Noctilio leporinus,* the bats can swim when necessary. Protective adaptations that would insure survival of these parasites would be of considerable importance, especially to the parasites of *leporinus,* a bat which frequently fishes in salt water. Another peculiarity of the parasites of these bats lies in the chaetotaxy. The bristles are strong, sparse, and semi-erect in all of the streblidae of *Noctilio,* including a species of an undescribed genus, which superficially resembles a large *Trichobius.* The fur of Noctilionidae has unusually short hairs (Benedict, 1957). Perhaps the strong semi-erect bristles give the flies additional purchase in the short pelage.

When we first studied our material of this genus, it appeared that there was only one species, *megastigma* (Speiser), that it occurred on both species of *Noctilio,* and that *N. dubia* (Rudow) was a synonym. As the picture of host-parasite specificity in Panamanian Streblidae developed, it no longer seemed reasonable that two bats that are as isolated ecologically as *Noctilio labialis* and *N. leporinus* should have the same species of parasite. We restudied both our Panamanian and other material and found that there were two species in Panama, one on each species of *Noctilio.* Our non-Panamanian material, too, seemed to segregate into these two forms. However, we were puzzled by the fact that the species which occurred on *N. labialis* in Panama seemed to replace the other species on *N. leporinus* in Venezuela, Trinidad, and Amazonian South America. We could understand that it might be possible for the parasite of *N. labialis* to occur on *N. leporinus* in areas to which the parasite of *leporinus* had not been able to disperse. However, if the parasite of *labialis* could live on both *labialis* and *leporinus* in some areas, it did not seem reasonable that it should be restricted to *labialis* in Central America, Cuba, and Peru, where the parasite of *leporinus* also occurred. That is, it did not seem reasonable unless a factor such as competitive exclusion were operating. This we were not willing to accept until we had eliminated another alternative, namely that we were dealing with a complex of closely related species rather than just two. Study of nearly all available additional material confirmed the latter suspicion.

We now know that there are about seven to nine species of *Noctiliostrebla,* five or six of them on *N. leporinus* and two or three on *N. labialis.* They may be separated into two groups. In the species of Group A, the aedeagus lacks a recurved dorsal subapical spine, while in Group B, the aedeagus possesses such a spine. Species of Group A apparently occur only on *N. leporinus;* one species (*N. aitkeni* n.sp.) of Group B occurs on *leporinus,* the others on *N. labialis.* It was the apparently anomalous occurrence of *aitkeni* on *N. leporinus leporinus* which caused us to re-examine our material. We are not yet in a position to revise the species in detail, but restrict our treatment to such species as necessary to enable us to apply names to the Panamanian species.

There are few records of flies of this genus occurring on bats other than Noctilionidae. Some of these undoubtedly represent contaminations and errors of association; however, some probably represent temporary transfers to other hosts, such as *Molossus,* with which the Noctilionidae sometimes roost.

The distributions of the species that occur on *Noctilio leporinus* seem to roughly correspond to those of subspecies of the host. This raises a number of interesting problems. Mr. Philip Hershkovitz tells us that these are "nominal" subspecies that do not bear close scrutiny. If these are interbreeding, intergrading populations of bats, it is quite possible that some of the species of *Noctiliostrebla,* too, will be shown to intergrade, as additional material becomes available. On the other hand, if such is not the case, one may raise the question as to whether or not the "subspecies" of *Noctilio leporinus* may actually be distinct species. While we recognize that speciation of host and parasite need not proceed at the same rate, nonetheless, the data suggest that a careful restudy of the Noctilionidae and their parasites, based on larger and more extensive geographic samples than are presently available, is in order.

The two species groups of *Noctiliostrebla* may be characterized as follows:

Female: Supra-anal plate with one or two long strong bristles on each side at mid-length (fig. 107D); sternum II very large, long, emarginate at middle of posterior margin (fig. 106B). *Male:* Aedeagus lacking a dorsal subapical spine (fig. 107B). Posterior margin of sternum II outwardly rounded or angulately projecting, the marginal setae at middle generally forming a false ctenidium (fig. 106A). .... Group A

Female: Supra-anal plate with one or two short bristles on each side at mid-length (fig. 107C). Sternum II shorter, strongly transverse, not emarginate at middle of posterior margin (fig. 109B). *Male:* Aedeagus with a dorsal subapical spine (fig. 107A). Posterior margin of sternum II straight or feebly arcuate, the bristles along middle of posterior margin not forming a false ctenidium (fig. 109A). .... Group B

Group A

In addition to the characters given above, it may be noted that all the species of this group, excepting one, lack setae near middle of the median wing vein; the species of Group B typically have one or two, but an undescribed species from Brazil has from two to five.

Noctiliostrebla dubia (Rudow), *new combination.*

Lipoptena dubia Rudow, 1871, Zeitschr. gesammte Naturwiss., 37, (n. s., 3), p. 122; 1872, Ann. Mag. Nat. Hist., (4), 9: 407—Venezuela, from *Noctilio dorsatus* [= *N. leporinus*]—(Zoologische Museum, Hamburg). Speiser, 1902, Syst. Hymen. Dipt., 2: 159–160 (synonymizes *Paradyschiria fusca* Speiser 1900 with *dubia*, in error).

Aspidoptera megastigma (not Speiser, 1900) Bequaert, 1942, Bol. Ent. Venez., 1, (4), p. 88.

Speiser (1902) synonymized his *Paradyschiria fusca* (Speiser, 1900) under *dubia* Rudow, 1871. He did so on the assumption that Rudow based his description of *dubia* on a mixed series containing three specimens of what Speiser regarded as his own *Lepopteryx megastigma* and a single specimen of his *Paradyschiria fusca*. This may have been true. According to Speiser (op. cit.) Rudow's series contained two specimens of *megastigma* in a Canada balsam mount and one each of *megastigma* and *Paradyschiria fusca* in alcohol. However, Speiser further attempted to demonstrate that Rudow based his description of *dubia* primarily on the specimen of *Paradyschiria*.

While it is apparently true that Rudow did have a mixed series, he certainly did not base his description on the single specimen of *Paradyschiria*, as Speiser maintained. This is clear from both the German (1871) and English (1872) versions of his paper. For example, in referring to the median and transverse mesonotal sutures, Rudow says "mit einigen bogenförmigen, quer und winkligen Längsfurchen von rother Farbe versehen." This obviously refers to the condition in *Noctiliostrebla*, since these sutures are largely membranous in *Paradyschiria*.

In 1962, Dr. T. C. Maa examined the Rudow types (slides only) of *Lipoptena dubia* and informed the senior author (pers. comm.) that they were the same as *Lepopteryx megastigma* Speiser. Because our studies of *Noctiliostrebla* indicated that a number of species had been confused under the name *megastigma*, it was important that the types both of Rudow's *dubia* and Speiser's *megastigma* be re-examined. Prof. Herbert Weidner of the Hamburg Museum kindly sent the slide of the male and female *Lipoptena dubia* Rudow with permission to remount them.

These were not in Canada balsam as stated by Speiser (1902) but mounted dry and pressed flat between slide and coverslip. The specimens were remounted after long immersion in a solution of trisodium phosphate followed by treatment with KOH and the usual dehydration, clearing and mounting in Canada balsam. The specimen had been preserved dry so long that it was not possible to restore the telescoped abdomen of the female to normal condition. The male proved to be unusually brittle, and in dissecting the male terminalia, the abdomen was damaged. However, it is now possible, we believe, to determine the specific status of this species, and it will be redescribed in a later paper. It differs conspicuously from *traubi* n.sp. (q.v.) in the characters of sternum II of the male. In *dubia*, the bristles of the posterior margin of sternum II do not form a ctenidial-like structure; they are somewhat thorn-like and shorter than those toward the sides; the discal setae are sparse, about eight in number.

The species probably does not occur in Panama. Unfortunately the exact type locality is unknown, but we believe that *dubia* occurs on an Amazonian race of *Noctilio leporinus*.

Noctiliostrebla megastigma (Speiser), *new combination.*

Lepopteryx megastigma Speiser, 1900, Arch. Naturg., 66A, Bd. I, pp. 54–55, pl. 3, fig. 2—Type locality unknown, off *Noctilio dorsatus* [=*N. leporinus*]—(Zoologisches Museum der Humboldt Universität, Berlin).

Aspidoptera megastigma Speiser, 1900, Zool. Anz., 23: 154; 1902, Zeitschr. Hymen. Dipt., 2: 159.

We have not examined the types of this species. Speiser had five dry specimens at the time he described it. According to Dr. T. C. Maa (pers. comm.) two are males and three are females. The country of origin is unknown. The host was given as "(*N*)*octilio* (*d*)*orsatus*" (=N. *leporinus*).

Early in our studies, we sent copies of figs. 106 and 109 to Dr. H. Schumann of the Zoological Museum at Humboldt University, Berlin, with the request that he compare these with the type of *megastigma*. His reply indicated that sternum II of the female was of the type found in *traubi* n.sp. and *dubia* Rudow, i.e., long and with the posterior margin emarginate at middle. On the other hand the male apparently has a simple type sternum II, i.e., with posterior margin relatively straight and without a false ctenidium. We have seen two species with this combination of male and female characters of sternum II. However, until we are able to examine and dissect a male of the type series, it is not possible for us to settle the identity of *megastigma*. It is clear that it is distinct from *traubi*, but it remains to be seen whether it is the same as *dubia* or is another species known to us from Amazonian Brazil.

Noctiliostrebla traubi Wenzel, new species. Figures 106; 107B, D.

Closely related to *N. dubia* (Rudow), 1871, and differing from it chiefly in that the posterior margin of sternum II is strongly produced at middle in the male, the marginal setae here more closely placed than they are laterally, subspiniform, distinctly longer than the discal setae, and forming a false ctenidium (fig. 106A). In *dubia*, the posterior margin of sternum II is apparently straight at middle in the male and the median marginal setae are scarcely if any longer than the discal setae and do not form a false ctenidium. In the female of both species the first sternum is emarginate at middle, unlike that of *N. maai* n.sp. and *N. aitkeni* n.sp. The head and thorax are nearly identical throughout the genus and are not described below.

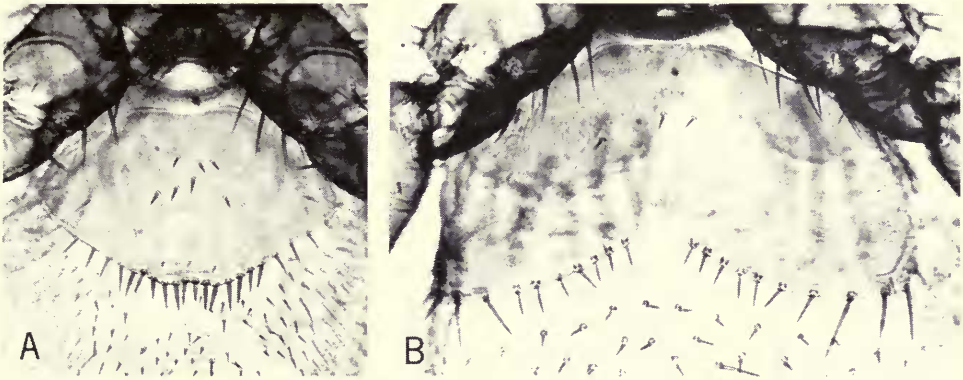

Fig. 106. *Noctiliostrebla traubi*, new species, sternum II. A, male holotype and B, female allotype from *Noctilio leporinus mexicanus* (no. 5113), Fort Sherman.

DESCRIPTION: *Wings.*—Tips subacuminate; apices with a coarse and a fine distal seta; outer margin with about four stronger submarginal and seven or eight marginal setae, inner margin with three or four marginals and four or five submarginals; middle vein without bristles near mid-length; vein along posterior margin usually divided into two veins which anastomose anteriorly and posteriorly. *Legs.*—Similar to those of *maai* and *aitkeni*. *Abdomen.*—*Female:* Lateral lobes of tergum I+II each with about 17 coarse setae, four to six of these (anteriorly and laterally) relatively short, being less than or only slightly more than half as long as the longest setae; inner margins on each side of mid-line, with four to eight additional small setae in a double row. Dorsal and lateral connexivum on each side posterior to tergum I+II with a cluster of about 10 setae that are coarser than the others but less than half as long as longest macrosetae of tergum I+II, and no more than twice as long as other dorsal connexival setae; a transverse row of setae between sixth spiracles slightly longer than other connexival setae near them. Tergum VII a thin transverse strip with four minute setae. Supra-anal plate as on other members of group A (fig. 107D), with four apical macrosetae and a shorter but strong seta on each lateral margin. Setae of lateral connexivum minute; setae of ventral connexivum of about the same size as dorsals, except for a few long setae of four segmental series. Sternum II (fig. 106B) very long, emarginate at middle with very few discal setae, marginal setae longer toward sides, but short along lateral margins. Seventh sternites very small, irregularly oval, usually with three or four shorter but conspicuous setae along apical margin, three long coarse setae just anterior to them and two to four very short (often thorn-like) setae anteriorly. *Male:* Tergum I+II generally similar to that of female, but macrosetae not as long; short setae along inner margin relatively longer than in the female. Sternum II (fig. 106A) posteriorly strongly produced or rounded at middle, with few discal setae, the median marginal setae longer than the median discal setae and more closely placed than the marginals towards the sides so as to form a false ctenidium. Gonapophyses (fig. 107B) shorter, more strongly curved than in *maai* and *aitkeni*, the aedeagus strongly laterally compressed as in those species but without a dorsal recurved subapical spine.

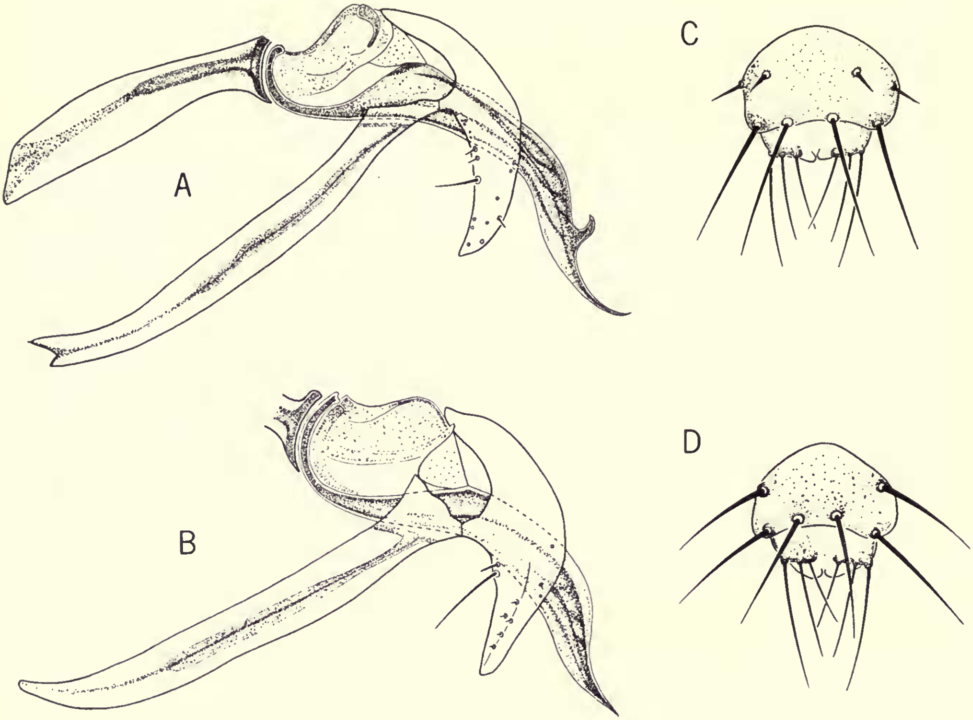

Fig. 107. Terminalia of species of *Noctiliostrebla*. A and B, male genital apparatus, lateral view: A, *Noctiliostrebla maai*, new species, paratype from *Noctilio l. labialis* (no. 6376), Río Tuira (Darién); B, *N. traubi*, holotype. C and D, terminal cone, female abdomen: C, *Noctiliostrebla aitkeni*, new species, female paratype from *Noctilio l. leporinus*, Manzanilla, TRINIDAD; D, *N. traubi*, new species, female from *Noctilio leporinus*, (CNHM 81166), Huásimo (Tumbes), PERU.

Measurements:	BL	TL
Male	1.59–1.65	0.49–0.55
Female	2.06–2.28	0.60–0.63

TYPE MATERIAL (from *Noctilio leporinus mexicanus*): Holotype male and allotype female (slides) from host no. 5113, cativo trees, Fort Sherman

(Canal Zone), 2 December 1959, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—1, same data as the holotype; 4, same data but 4 December; 14 (2 lots), Río Tuira (Darién), 5 March 1958, P. Galindo [GML]; 4, from preserved museum specimens collected at Río Santo, near Pacora (Panamá), 9 February 1935, by H. C. Clark [CNHM]. Non-Panamanian paratypes.—7, Fortuna, 2 miles west of Pandora, Estrella Valley (Limon), COSTA RICA, H. W. Setzer [CNHM]. Paratypes to be deposited in the collections of Chicago Natural History Museum; the United States National Museum; the Gorgas Memorial Laboratory, Panamá; Environmental Health Branch at Corozal (Canal Zone); the Departamento de Zoologia, Secretaria da Agricultura, São Paulo, Brazil; and the Bernice P. Bishop Museum, Honolulu.

OTHER MATERIAL EXAMINED.—From *Noctilio leporinus:* 3, Huásimo (Tumbes), PERU, 750 meters elevation, 25 June 1954, C. Kalinowski, CNHM Peru Zoological Expedition (1953–54); 3, Río Guimaral, Valledupar (Magdelena), COLOMBIA, 18 September, no. 682, lot no. 69 [USNM]. We have also seen specimens taken in CUBA from *Noctilio leporinus mastivus* at Los Amacegos, 1 mile west of Santa Fé, Isle of Pines, and from Ariguanabo (Havana), H. Jaume [MCZ]. These differ slightly from our Panamanian specimens and could represent a separate entity.

REMARKS: This species is named for Colonel Robert Traub, USA–MSC (Retired), now at the School of Medicine, University of Maryland, not only in recognition of his outstanding contributions to the systematics of fleas, our knowledge of ectoparasites generally, and many other aspects of medical entomology, but also in appreciation of his invaluable assistance and cooperation through the years.

Group B

Noctiliostrebla aitkeni Wenzel, new species. Figures 107C, 108.

Aspidoptera megastigma (not Speiser, 1900), Jobling, 1949, Proc. Roy. Ent. Soc. Lond., (B), 18: 140–142, fig. 3 (part.: description, figure, and Trinidad record); Goodwin and Greenhall, 1961, Bull. Amer. Mus. Nat. Hist., 122: 220.

This species is closely related to *N. maai* n.sp. and to an undescribed species from Bolivia. It is the only species of Group B which occurs on *Noctilio leporinus* (subsp. *leporinus*). The males are very similar to those of *N. maai* excepting as follows: there is a single rather than a double row of setae along inner margin of tergum I+II, the gonapophyses are slightly more slender and are subacuminate at apex. The females are easily distinguished from *maai* by the very conspicuous cluster of long coarse connexival setae on each side posterior to tergum I+II and by the strong segmental groups of setae usually present posteriorly, medial to the spiracles on each side.

Dr. Harold Oldroyd of the British Museum (Natural History) kindly sent us the female (slide) upon which Jobling based his illustration, from Pointe Gourde Caves, Trinidad. The description and illustrations of *A. megastigma* Jobling (loc. cit.), apply to this species as does his record from Trinidad. In his figure, the coarse setae of the dorsal abdominal connexivum

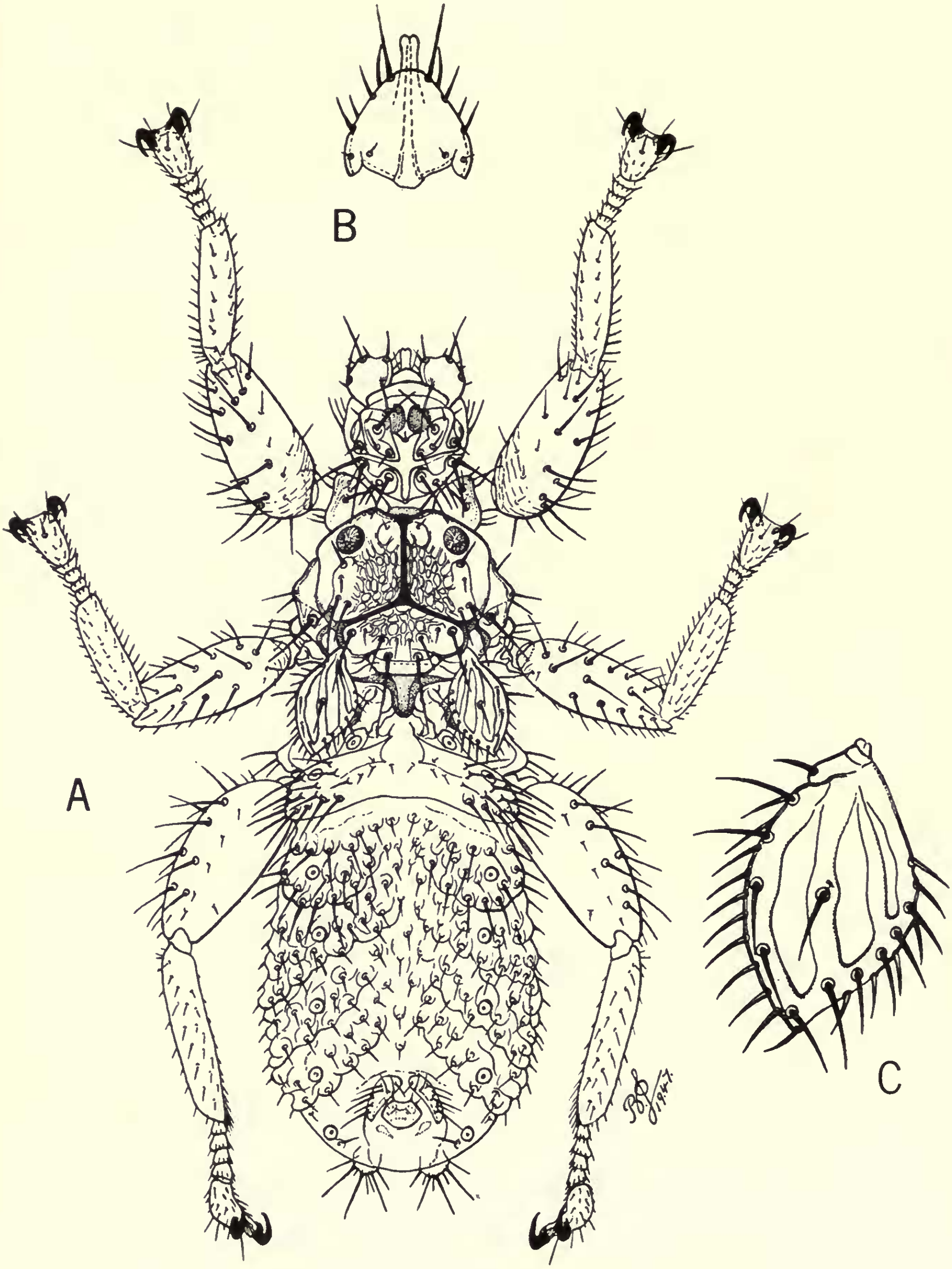

Fig. 108. *Noctiliostrebla aitkeni*, new species, female. A, dorsal view. B, labium. C, wing. From Jobling (1949a, as *Aspidoptera megastigma*). Specimen from *Noctilio l. leporinus*.

do not appear as long as they actually are. To Jobling's description, the following may be added:

Abdomen.—Posterior margin of sternum II nearly straight in both sexes, and nearly identical to that illustrated for *maai* n.sp. (fig. 109). *Female:* Lateral lobes of tergum I+II with about 18 coarse setae; dorsal inner margin with three to five short setae, usually in a single row. Connexivum on each side, posterior to tergum I+II, with a cluster of 12 very long setae, most of them as long as the shorter macrosetae of the lateral lobes of tergum I+II, some of them more than half as long as the longest macrosetae; medial to each of spiracles IV and V on each side of mid-line, are one or more coarser setae. Seventh tergites each with six to eight macrosetae, four of them in a transverse row across middle. *Male:* Inner margins of lateral lobes of tergum I+II with three or four, rarely five setae in a single row on each side. Genital apparatus very similar to that of *maai* n.sp. (fig. 107A).

Measurements:	BL	TL
Male	1.65–1.76	0.55–0.58
Female	1.95–2.20	0.60–0.66

TYPE MATERIAL: Holotype male and allotype female (slides) from *Noctilio l. leporinus*, Manzanilla, TRINIDAD, 13 March 1957, T. H. G. Aitken. In the collection of Chicago Natural History Museum.

Paratypes.—55, same data as the holotype [TVL]; 3 Scotland Bay, TRINIDAD, September 1954, C. C. Sanborn, CNHM Trinidad Zoological Field Trip (1954); 2, Monos Island, B. W. I. [FCUCV]; 16, Kaiserberg Airstrip, east of Zuid River, SURINAM, 12 October 1960, H. A. Beatty, CNHM Guianan Zoological Expedition (1960–62), 2, same expedition, Saramacca River, Loksie Hattie (Brokopondo), SURINAM, 5 January 1962, P. Hershkovitz; 8, Quebrada Esperanza, Río Yauari-Mirim, Maynas (Loreto), PERU, 23 September 1957, C. Kalinowski, CNHM Peru Zoological Expedition (1956–57). Paratypes in the collections of Chicago Natural History Museum; the United States National Museum; the Bernice P. Bishop Museum, Honolulu; Facultad de Ciencias, Universidad Central de Venezuela, Caracas; Departamento de Zoologia, Secretaria da Agricultura São Paulo, Brazil; and the Trinidad Regional Virus Laboratory, Port-of-Spain.

REMARKS: This species is named for Dr. Thomas G. Aitken, of the Trinidad Virus Laboratory (Rockefeller Foundation), in recognition of his valuable contributions to medical entomology.

Noctiliostrebla maai Wenzel, new species. Figures 107A, 109.

Closely related to *N. aitkeni* n.sp., but differing as indicated under that species.

DESCRIPTION: *Abdomen.—Female:* Lateral lobes of tergum I+II with 10–14 coarse setae, and on dorsal inner margin with seven to nine short setae in a double row. Connexivum on each side posterior to tergum I+II with a cluster of 14–16 setae that are coarser than other dorsal and lateral connexival setae, but none more than twice as long as other connexival setae and less than half as long as macrosetae of tergum I+II; a longer seta sometimes present medial to spiracle V; between sixth spiracles is a row of four long setae; seventh tergites with four or five setae, four of them macrosetae. Supra-anal plate as in *N. aitkeni* n.sp. (fig. 107C). *Male:* Inner margin of each lateral lobe of tergum I+II with six to nine, rarely 10 setae in a double row.

Measurements:	BL	TL
Male	1.54–1.63	0.47–0.51
Female	1.87–1.98	0.49–0.55

TYPE MATERIAL: Holotype male and allotype female (slides) from *Noctilio labialis labialis* (host no. 6376), Río Tuira (Darién), 3 March 1958, Pedro Galindo. In the collection of Chicago Natural History Museum.

Paratypes.—From *Noctilio labialis labialis:* 19, same data as holotype; 2, Río Chucanaque (Darién), L. H. Dunn [MCZ]; 10, Juan Mina (Canal Zone), 16 August 1945, H. Trapido [CNHM]; 7, Chilibrillo Caves (Panamá), L. H. Dunn [MCZ]. From *Noctilio labialis:* 7, Playo del Medio (Bolivar), VENEZUELA, 19 April 1961, T. Ojasti [FCUCV]. Paratypes in the collection of Chicago Natural History Museum; the United States National Museum; the Museum of Comparative Zoology at Harvard; the Gorgas Memorial Laboratory; the Environmental Health Branch, USAFSC at Corozal (Canal Zone); Facultad de Ciencias, Universidad Central de Venezuela; Departamento da Zoologia, Secretaria da Agricultura, São Paulo, Brazil; and the Bernice P. Bishop Museum at Honolulu.

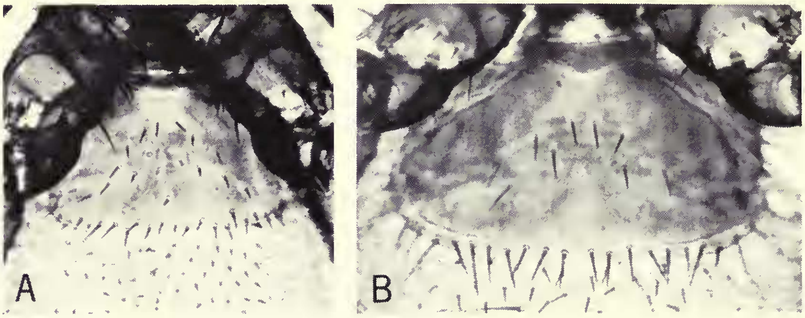

Fig. 109. *Noctiliostrebla maai,* new species, sternum II. A, male holotype. B, female allotype.

REMARKS: This species is named for Dr. Tsing C. Maa, in appreciation of the valuable assistance given by him, and in recognition of his important contributions to our knowledge of the batflies.

KEY TO PANAMANIAN SPECIES OF *NOCTILIOSTREBLA*

Median wing vein usually with one or two (rarely none) setae near middle. Posterior margin of sternum II (fig. 109) straight or nearly so, in both sexes, the marginal setae rather uniformly distributed. *Female:* Supra-anal plate much as in *aitkeni* (fig. 107C) with a pair of short setae on each side, one inserted at middle of lateral margin, the other on dorsal surface of plate at about lateral fourth. *Male:* Gonapophyses (fig. 107A) similar to those of *aitkeni;* aedeagus with a dorsal subapical spine. Host: *Noctilio labialis labialis* .... *maai* n.sp.

Median wing vein without setae near middle. Posterior margin of sternum II broadly emarginate (fig. 106B) in female; outwardly arcuate or angulate (fig. 106A) in the male, the median marginal setae subspiniform and more closely set, so as to form a false ctenidium. *Female:* Supra-anal plate (fig. 107D) typically with a strong seta on each side along lateral margin and a very short one ventral to it. *Male:* Gonapophyses as in fig. 107B; aedeagus without a dorsal subapical spine Host: *Noctilio leporinus mexicanus* .... *traubi* n.sp.

Genus **Paradyschiria** Speiser

Paradyschiria Speiser, 1900, Arch. Naturg., 66A, Bd. I, pp. 38, 55–56 (diagn.), 62, 65 (keyed). Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, 5: 25 (keyed), 29 (cit.). Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 13 (keyed), 26–27 (char., key to spp.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 658. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479 (keyed); 1935, Amer. Mus. Novit., no. 765, p. 5 (keyed). Jobling, 1936, Parasitology, 28: 357 ff. (morph., syst. pos.). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 418 (keyed); 1942, Bol. Ent. Venez., 1: 86 (keyed). Jobling, 1949, Parasitology, 39: 321 (keyed); 1951, Trans. Roy. Ent. Soc. Lond., 102: 216 (morph. abdomen). Grandi, 1952, Introd. Studio Ent., 2: 478.

Type-species: *Paradyschiria fusca* Speiser, 1900.

The species of this genus are the only apterous Streblidae known and superficially resemble small Nycteribiidae. This resemblance is enhanced by the extensive membranous areas of the mesonotum with accompanying reduction of the sclerites. The females of *P. fusca* Speiser and *lineata* Kessel are unique in possessing a vertical sclerite in the lateral connexivum between the posterior margins of the lateral lobes of tergum I+II and spiracle III. This is feebly sclerotized excepting a narrow strip along anterior margin which is more strongly sclerotized and easily visible in slide preparations as well as on specimens in alcohol. The female cerci are free and not united with the ventral arc.

We tentatively recognize four species of this previously monotypic genus. Two of them, *P. lineata* Kessel and *P. parvuloides* n.sp., occur in Panama.

PROVISIONAL KEY TO SPECIES OF *PARADYSCHIRIA*

1. Mesonotum (fig. 114A) with a short seta (rarely absent) anterior and lateral to the long macroseta of postero-lateral angle. *Female:* Lateral abdominal connexivum without a vertical sclerite between tergum I+II and spiracle III. Terminal cone (fig. 112D) with the usual four apical macrosetae, and with a short seta along each lateral margin and a pair of short discal setae at mid-length. *Male:* Gonapophyses slightly but distinctly hooked at apex 2

   Mesonotum without a short seta anterior and lateral to the long macroseta of postero-lateral angle. *Female:* Lateral abdominal connexivum with an elongate-oval, vertical sclerite between posterior margin of lateral lobe of tergum I+II and spiracle III. Terminal cone (fig. 112B) with or without short discal setae, and in addition a pair of macrosetae, one on each side near posterior angle. *Male:* Right gonapophysis (fig. 113A) straight at apex, the left very feebly hooked at apex 3

2. *Female:* Seventh sternites (fig. 112C) with from two to four spine-like setae on apical margin. *Male:* Gonapophyses rather abruptly tapered on apical half .... *parvuloides* n.sp.

   Female: Seventh sternites with normal setae along apical margin. *Male:* Gonapophyses rather evenly tapered to apex .... *parvula* Falcoz

3. Posterior margin of tergum I+II usually with one (rarely two) macrosetae that are conspicuously longer than the others (figs. 111A). *Female:* Mid-dorsal setae of abdominal connexivum conspicuously shorter than those lateral to them, those near base and apex shortest, the apical ones less than half as long as the setae lateral to them (figs. 110A, B). Terminal cone (fig. 112B) usually with baso-lateral macrosetae more widely separated than the outer setae of apical margin .... *lineata* Kessel

   Posterior margin of tergum I+II usually with two or three long subequal macrosetae that are conspicuously longer than the others. *Female:* Most of mid-

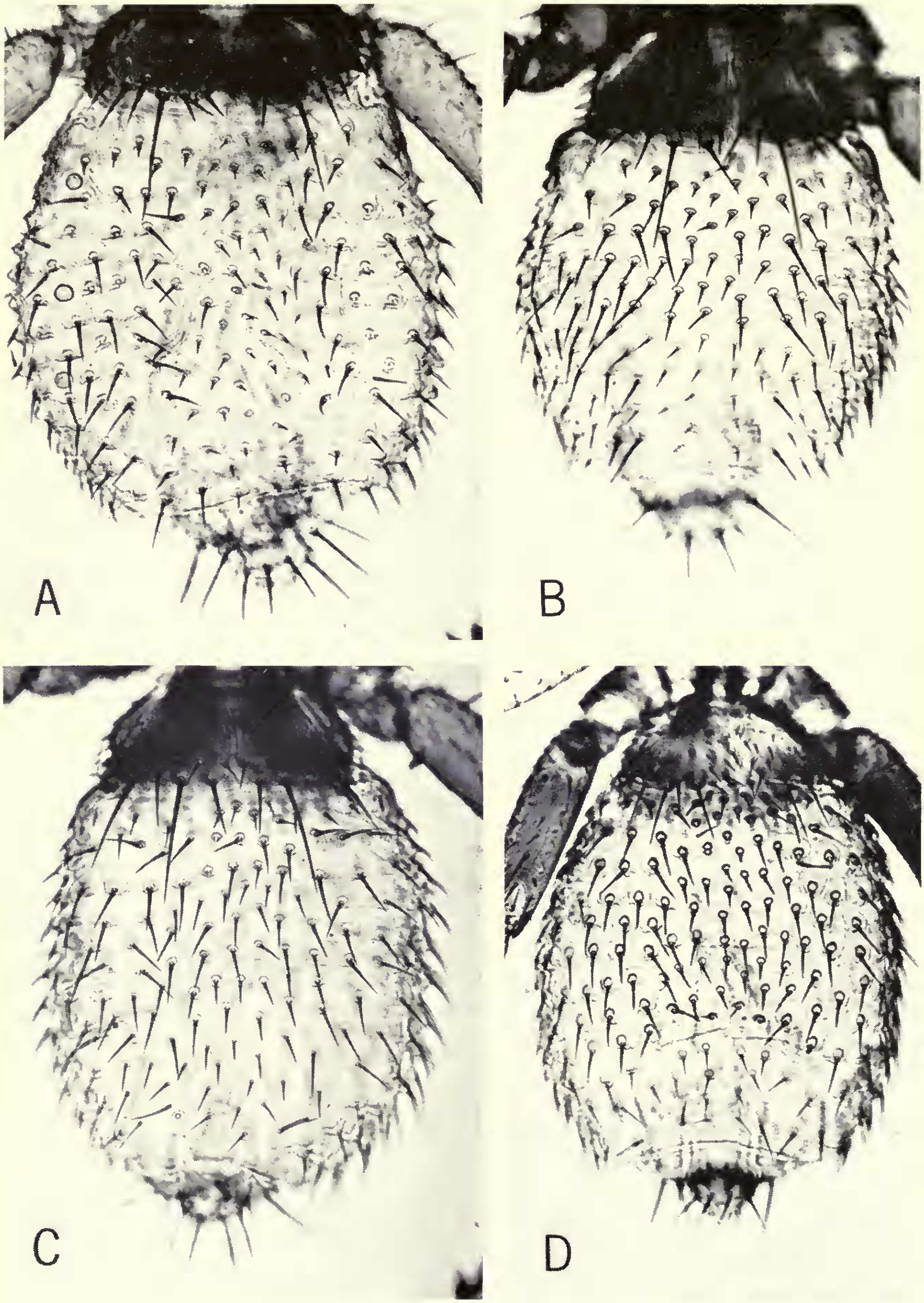

Fig. 110. Female abdomen, dorsal view, of species of *Paradyschiria.* A and B, *P. lineata* Kessel; A, from *Noctilio leporinus mastivus*, Central Mercedes, Mátas, CUBA; B, from *N. l. mexicanus* (no. 5558), Changuinola (Bocas del Toro). C, *P. fusca* Speiser, from *N. l. leporinus*, Manzanilla, TRINIDAD. D, *P. parvuloides*, new species, from *N. l. labialis* (no. 6376), Río Tuira (Darién).

dorsal setae of abdominal connexivum (fig. 110C) shorter than those lateral to them, but not markedly so, many more than half as long as the setae lateral to them. Baso-lateral macrosetae of terminal cone usually no more widely separated than outer macrosetae of apical margin .... *fusca* Speiser

Paradyschiria fusca Speiser. Figures 110C, 111B.

Paradyschiria fusca Speiser, 1900, Arch. Naturg., 66A, Bd. I, pp. 56–57 (descr.), 62 (cat.), 65 (keyed), pl. 3, fig. 1—Orocué, Colombia, from *Noctilio leporinus* (Type repository unknown). [?] Cole, 1927, Proc. Calif. Acad. Sci., **16**: 453 (morph. male genit.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 658.

Paradyschiria dubia (not Rudow, 1871), Speiser, 1902, Zeitschr. Syst. Hymenop. Dipt., **2**: 159 (synonymizes *P. fusca* Speiser, in error). Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 27. Stiles and Nolan, 1931, op. cit., p. 658 (part.). Costa Lima, 1921 Arch. Esc. Sup. Agric. Med., Nictheroy, **5**: 29 (part.). Bequaert., 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., **3**: 418. Guimarães, 1941, Papèis Avulsos, Dept. Zool. Secret. Agric., São Paulo, **1**: 217–222, figs. 1–4 (redescr.); 1944, loc. cit., **6**: 186, figs. 5–9 (larva). Jobling, 1949, Parasitology, **39**: 316 ff., 328, fig. 3A (part.; synonymizes *P. lineata* Kessel, 1925 and *P. parvula* Falcoz, 1931). Goodwin and Greenhall, 1961, Bull. Amer. Mus. Nat. Hist., **122**: 220.

Dr. T. C. Maa has informed us (pers. comm.) that he was unable to locate the type of *P. fusca* and that it is probably lost. Thus, any interpretation must be based upon Speiser's description and figure and the type host and type locality. Unfortunately, these do not permit us to determine which (if any) of the four species that we have segregated is *fusca*. His figure only permits one to determine that it is a *Paradyschiria*. No lateral macrosetae are shown on the supra-anal plate. This suggests that the species is either *parvuloides* n. sp. or one which we tentatively refer to *P. parvula* Falcoz. However, the figure does not show a small seta anterior and lateral to the posterior macroseta of the mesonotum. This is present in both *parvuloides* and *parvula*, neither of which occur on *Noctilio leporinus*. We doubt that there is a species with the combination of characters shown by Speiser and conclude that his illustration is too inaccurate to permit recognition of *P. fusca*. His description is of no help.

The principal clues to its identity, then, are the type locality and type host. According to Bequaert (1940, p. 418), the type locality—Orocué, Colombia—is in the Department of Boyacá. He was unaware, apparently, that there is also a locality of that name in the Department of Vaupés. Both are in Amazonian Colombia, and in all likelihood the same species of *Paradyschiria* occurs on *Noctilio leporinus* in both localities. *P. lineata* occurs in coastal Colombia, but judging from the distribution patterns of other streblids, including those on Noctilionidae, we doubt that it occurs in Amazonian Colombia. We have studied specimens—from Trinidad, Venezuela and Surinam—of a closely related population which we provisionally interpret as *fusca*. It appears to be the species redescribed and figured by Guimarães (1941) as *P. dubia*, from Brazil. The specimens from Trinidad and Surinam are easily distinguishable from our Panamanian specimens of *lineata*, but those from Venezuela are difficult to separate. Perhaps *P. fusca* (*sensu* Guimarães, 1941) and *lineata* Kessel represent clinal extremes.

Designation of a neotype of *fusca* must be deferred until specimens from near the type locality are available.

Paradyschiria lineata Kessel. Figures 110A, B; 111A; 112A, B; 113A.

Paradyschiria lineata Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 27–28—Cuba (British Museum of Natural History). Jobling 1949, Parasitology, **39**: 328 (as synonym of *P. dubia* Speiser, 1902, not Rudow 1871, in error).

Jobling (loc. cit.) synonymized *P. lineata* Kessel under *P. dubia* Speiser 1902 (= *P. fusca* Speiser), not Rudow, 1871. As indicated above, the specific identity of *P. fusca* Speiser is uncertain, though it seems that it is not the same as *lineata* Kessel, described from Cuba. We cannot separate our Panamanian specimens, taken from *Noctilio leporinus mexicanus*, from Cuban specimens taken from *N. l. mastivus*. We therefore apply Kessel's name to the specimens from Panama.

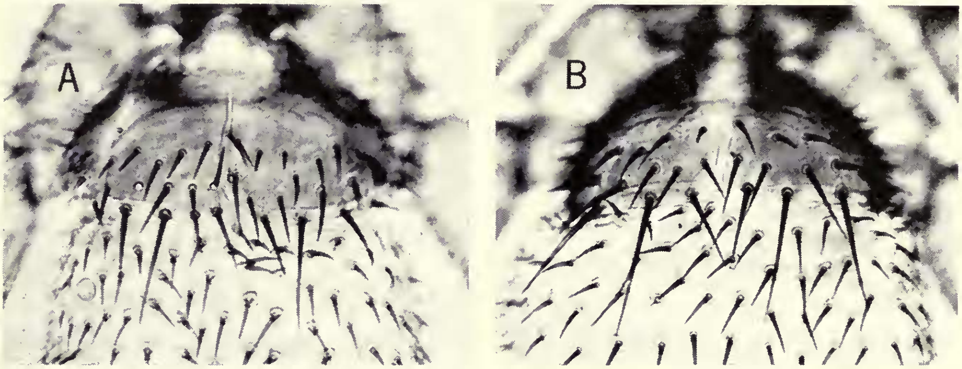

Fig. 111. Abdominal tergum I+II, male. A, *Paradyschiria lineata* Kessel, from *Noctilio leporinus mastivus* (CNHM no. 93668), Los Amacegas, Isle of Pines, CUBA. B, *P. fusca* Kessel, from *N. l. leporinus*, Manzanilla, TRINIDAD.

Measurements:	BL	TL
Male	1.37–1.87	0.41–0.47
Female	1.76–1.98	0.47–0.49

PANAMANIAN MATERIAL EXAMINED.—From *Noctilio leporinus mexicanus:* 22 specimens (4 lots) as follows: 12 (1 bat), Changuinola (Bocas del Toro), 29 February 1960; 10 (3 bats), Fort Sherman (Canal Zone), 2 and 4 December 1959; 1, removed from preserved museum specimen collected at Río Santo, near Pacora (Panamá), H. C. Clark, 9 February 1935 [CNHM].

OTHER MATERIAL EXAMINED: CUBA.—From *Noctilio leporinus mastivus:* 1, removed from preserved museum specimen from Los Amacegos, 1 mile west of Santa Fé, Isle of Pines, February 1961, Gilberto Silva [CNHM]; 1, Ariguanabo (Havana), H. Jaume [MCZ].

Paradyschiria parvula Falcoz

Paradyschiria parvula Falcoz, 1931, Parasitology, **23**: 267, figs. 4, 5—Brazil, from *Dirias albiventer* [= *Noctilio labialis*] (Museum National d'Histoire Naturelle, Paris). Jobling, 1949, Parasitology, **39**: 328 (as syn. of *P. dubia*, in error).

Paradyschiria dubia (not Rudow, 1871), Costa Lima, 1921 (part.), Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, **5**: 23 (host record from *N. labialis*), 29 (cat.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 658 (part.). Guimarães, 1941, Papèis Avulsos, Secret. Agric., São Paulo, **1**: 221 (part., record from *Noctilio albiventer*).

We have not examined the type of *P. parvula*, but we have a series collected by Dr. Merl Kuns from *Noctilio labialis* at San Joaquin (Beni), BOLIVIA, which we provisionally identify as this species. It is closely related to *parvuloides* n.sp. but is easily separated by the characters of the female seventh sternites (see key). In addition to the characters given in the key, *parvula* and *parvuloides* may be separated from both *fusca* and *lineata* by their smaller size and the relatively uniform, subequal macrosetae of the posterior margin of tergum I+II.

A small series received from Dr. Machado-Allison and collected in Venezuela at Playo del Medio (Bolivar) and Calabozo (Guarico), VENEZUELA, may be this species. However, they represent a puzzling mixture of characters of *parvula, parvuloides,* and *fusca* and more extensive series will be needed to determine their identity. They could represent a mixture of species, or an undescribed species, but it is also possible, as may be the case with some other streblids, that *parvula* and *parvuloides* represent either clinal extremes or subspecies, and that eastern Venezuela is an area of hybridization or an intermediate point on a cline.

Paradyschiria parvuloides Wenzel, new species. Figures 110D; 112C, D; 113B; 114.

Paradyschiria dubia (not Rudow, 1871), Cooper, 1941, Yearb. Amer. Phil. Soc., 1941: 126 (chromosome no.). Jobling, 1949, Parasitology, **39**: 316 (table 1), 328 (part., records from *Dirias albiventer minor*, Panama).

Differing from *P. lineata* Kessel and *fusca* Speiser in having a short seta (fig. 114A) lateral and slightly anterior to the posterior mesonotal macroseta (absent in *fusca* and *lineata*), and in lacking lateral macrosetae on the supra-anal plate of the female (fig. 112D). In these respects it resembles *P. parvula* Falcoz (of our interpretation) but differs from it and from both *fusca* and *lineata* in having from two to four short stout spine-like setae (fig. 112C) rather than normal setae on apical margins of seventh sternites of female. The male gonapophyses are rather abruptly tapered on apical half, rather than evenly tapered as in *parvula*.

DESCRIPTION: *Head.*—As in *P. lineata* and *P. fusca*. *Thorax.*—As in those species, except that a short seta is present on prescutum on each side, lateral and slightly anterior to the postero-lateral macroseta (fig. 114A). *Abdomen.*—Sternum I+II setose in a median, roughly triangular area, the marginal setae longer toward sides. *Female:* Tergum I+II with (as usual) a pair of isolated setae near base; on each lobe there are well developed setae near mid-line on apical half and laterally on lateral half; usually one or two conspicuously longer and stouter submarginal setae near apical margin and a row of eight or nine setae along apical margin of each lobe, three or four of them much longer than the others. Tergum VII+supra-anal plate (terminal cone) well sclerotized and pigmented, with four apical macrosetae, a pair of short discal setae at mid-length, and a minute seta at each posterior angle, lateral to the outer macroseta. Seventh sternites scarcely longer than broad, with eight to ten short setae basally and two much longer, slender subapical setae, the outer seta nearly twice as long as the inner; with an apical row of three or four short, spine-like setae and lateral to them a stout seta which is nearly as long as the subapical macroseta. Dorsal and lateral connexivum clothed with moderately long setae, these slightly shorter along mid-line, those at extreme base and beyond middle as long as the setae lateral to them; setae of ventral connexivum very short, except for pairs of segmental setae; all setae borne on sclerotized plaques. *Male:* Tergum I+II with setae of posterior margin shorter than in female, three or four usually longer than others but not more than twice as long as discal setae. Connexivum covered with dense, relatively short setae, these shortest along the sides; ventral setae only a little shorter than dorsal setae. Sternum V divided into two short transverse oval sclerites bearing about six bristles each, four along apical margin, two near outer margin. Hypopygium covered with setae similar to those of connexivum, except for two or three longer slender setae apically near inner margin. Gonapophyses and aedeagus as shown in fig. 113B, abruptly tapered apically, in lateral view, and slightly hooked at apex.

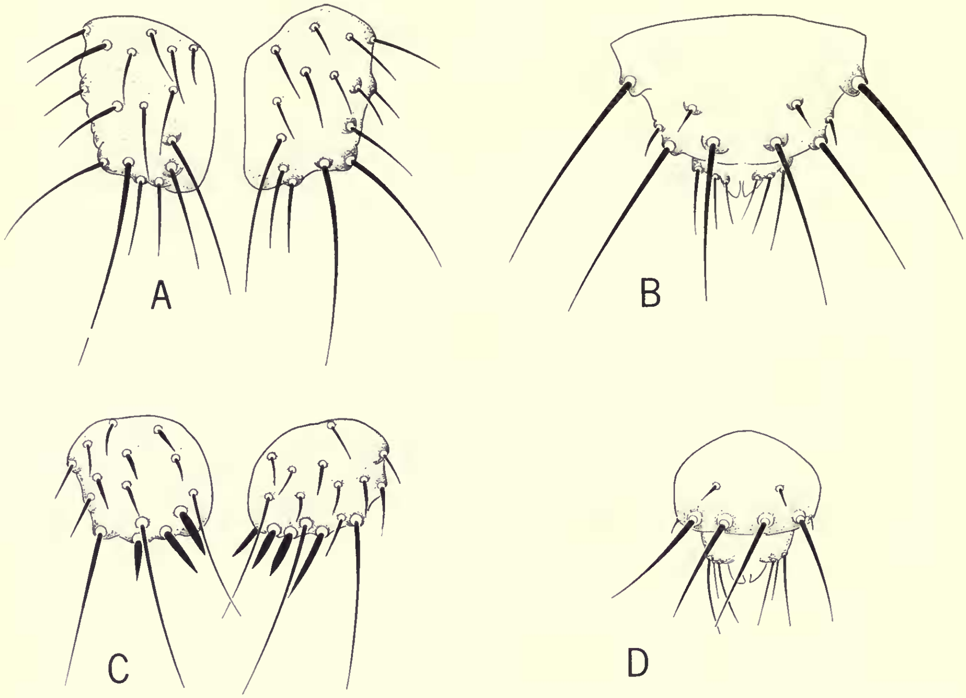

Fig. 112. A, seventh sternites and B, terminal cone, female abdomen of *Paradyschiria lineata* Kessel, from *Noctilio leporinus mexicanus* (no. 5558), Changuinola (Bocas del Toro). C and D, same structures, *P. parvuloides*, new species, paratype from *Noctilio l. labialis* (no. 6376), Río Tuira (Darién).

Measurements:	BL	TL
Male	1.30–1.48	0.38–0.42
Female	1.37–1.66	0.38–0.41

TYPE MATERIAL (734 specimens, 26 lots, from *Noctilio labialis minor*): Holotype male and allotype female (slides), host no. 6374, Río Tuira

(Darién), 2 March 1958, Pedro Galindo [GML]. In the collection of Chicago Natural History Museum.

Paratypes.—5 (1 bat), Fort Davis (Canal Zone), 26 October 1960; 3, Galeta Island (Canal Zone), 19 November 1959; 1, Gamboa (Canal Zone), 19 September 1960; 1, Juan Mina (Canal Zone), 20 April 1954, P. Galindo [GML]; 10, same locality, 16 August 1945, H. Trapido; 2, from preserved bats collected at Los Cáscadas (Canal Zone), 1933, by L. H. Dunn [CNHM]; 2, Barro Colorado Island (Canal Zone), 5 December 1956, C. B. Koford [USNM]; 5 (2 lots), Summit (Canal Zone), 30 September 1932, L. H. Dunn [CU]; 4 (slides), same data [BMNH—Jobling Collection]; 121, same locality and collector, 5 August 1930 [AMNH]; 3, same locality, K. W. Cooper [MCZ]; 8, Salamanca, Río Pequeni (Canal Zone), 1 April, Griswold [MCZ]; 1, Pacora (Panamá), 6 June 1961; 1 from preserved bat collected at Panamá (Panamá) [CNHM]; 202 (3 lots), Chilibrillo Caves (Panamá), L. H. Dunn [MCZ]; 15, same locality [USNM]; 17, same locality, L. H. Dunn [CU]; 2, Río Mono Camp (Darién), 25 July 1963, Wilbur Lowe; 137, same locality, 3 March 1958, P. Galindo [GML]; 5, Río Chucanaque (Darién), L. H. Dunn [MCZ]; 39, same data as holotype, and 133, same data but 2 March 1958; 4 (alcohol), "Darien," 4 February 1933, L. H. Dunn [BMNH—Jobling collection, det. as *P. lineata* Kessel, by Jobling]; 1, near Río Guánico, Guánico (Los Santos), 8 February 1962. From *Sturnira lilium parvidens:* 1, same locality, 8 February 1962.

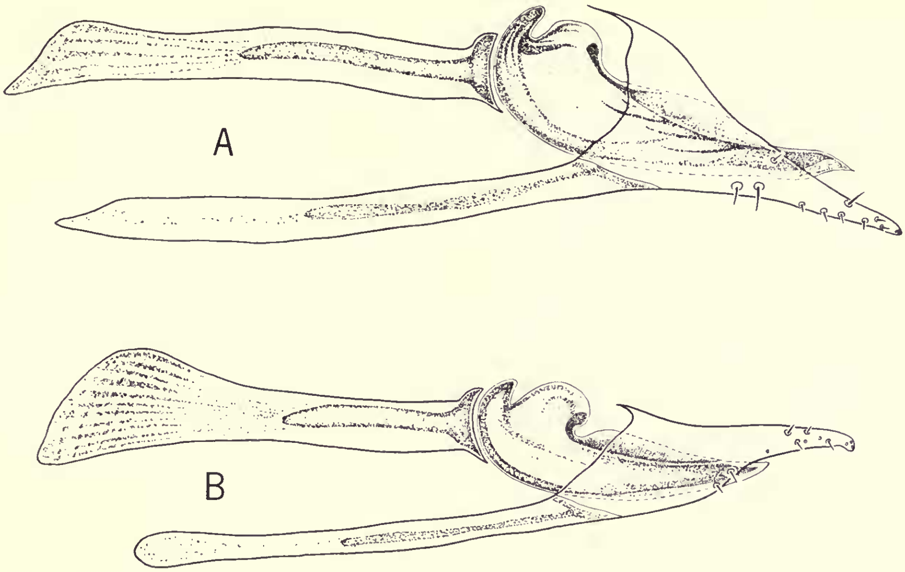

Fig. 113. Male genital apparatus, left lateral view. A, *Paradyschiria lineata* Kessel, same host data as for fig. 112A. B, *P. parvuloides*, new species, paratype from *Noctilio l. labialis* (no. 6374), Río Tuira (Darién).

Non-Panamanian paratypes.—75 (6 lots) from *Noctilio labialis* as follows: 26, 6 miles west of Rama, Bluefields, NICARAGUA, elevation 50 feet, 29 April 1963, D. C. Carter; 26, 9 miles NE of Puerto Gulfito (Puntarenas) COSTA RICA, 29 April 1963, D. C. Carter; 18, Unguía, Golfo de Urabá (Choco) COLOMBIA, 8–11 March 1950, P. Hershkovitz, CNHM Colombian Zoological Expedition (1948–52); 7, Río Docompado (Cauca), COLOMBIA, 350 meters elevation, 26 September 1958, Kjell von Sneidern, CNHM Colombian Zoological Expedition (1958–59); 8 (from type specimen of *Noctilio minor* Osgood), Encontrados (Zulia), VENEZUELA, 15 February 1908, Ned Dearborn, Field Museum Expedition (1908). Paratypes to be deposited in the collections listed on p. 410.

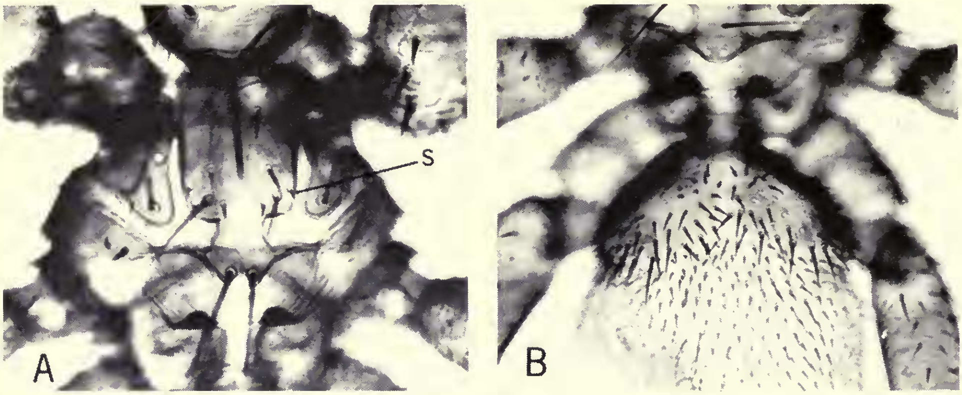

Fig. 114. *Paradyschiria parvuloides*, new species, male. A, thorax, dorsal view (*s* = seta antero-lateral to posterior mesonotal macroseta). B, base of abdomen and thorax, showing posterior chaetotaxy of tergum I+II.

REMARKS: This species appears to be restricted to *Noctilio labialis* and possibly to the subspecies *minor* Osgood. The single specimen from *Sturnira lilium parvidens* (no. 9351) is probably a contaminant from a specimen of *N. l. minor* (no. 9352) collected at the same time.

Parastrebla Wenzel, new genus

Type-species: *Parastrebla handleyi* Wenzel, new species.

Similar to *Pseudostrebla, Speiseria,* and *Trichobius,* but differing as follows: from *Pseudostrebla* in that the laterovertices lack a pigmented suture, the postvertex is membranous and the head is deep and not flattened; from *Trichobius* and *Speiseria* in having conspicuous tibial macrosetae; from *Speiseria* in not having greatly elongated hind legs; and from all other known New World Streblidae by the presence in the female (male unknown) of a ventral, feebly sclerotized, subapical abdominal plate (fig. 116B) bearing blunt spines, anterior to the seventh sternites.

DIAGNOSIS: *Head.*—Distinctly narrower than thorax; width greater than length from base of occipital lobes to apex of frontoclypeus; about as high as wide. Eyes faceted, not projecting beyond postgenae. Laterovertices and occipital lobes well defined, the latter somewhat inflated; laterovertices lacking a diagonal suture. Palpi oval, approximately as broad as long, with both ventral and marginal setae. *Thorax.*—Widest at level of transverse suture, narrowing apically; median suture present; humeral calli slightly produced but not prominent. *Wings.*—Venation as in *Trichobius;* anal vein with several strong setae near basal angle. *Legs.*—As in *Pseudostrebla,* the middle and hing legs progressively longer than the forelegs, the hindlegs not greatly elongated. All tibiae with conspicuously long macrosetae in addition to short setae. *Abdomen.*—As in *Trichobius,* but female with a very feebly sclerotized plate (sixth sternum?), anterior to seventh sternites, whose apical margin has a row of nine or ten blunt spines. Ventral arc well developed, translucent, with conspicuous flanges. Sternopleura and pleurotrochantines as in *Speiseria, Pseudostrebla* and *Trichobius phyllostomae,* the anterior margin projecting between coxae and angulately emarginate.

REMARKS: The female genital structure of *Parastrebla* is very similar to that of the *Trichobius major* group, especially of *T. truncatus* Kessel. However, we cannot determine with certainty, from the slide preparation, whether or not the cerci are fused or articulated with the ventral arc. The structure of the head and abdomen suggest that the genus is in some ways intermediate between *Trichobius* on the one hand, and *Pseudostrebla* on the other.

Parastrebla handleyi Wenzel, new species. Figure 116.

DESCRIPTION (*Female*): *Head.*—Eyes small, transverse, with seven or eight indistinct facets. Genae and postgenae with numerous, short, discal setae and conspicuously longer marginal setae. Laterovertices subquadrate, declivous anteriorly, with about six conspicuous and one short setae. Occipital lobes each with three very long and about six other strong, shorter setae.

Thorax.—Anterior margin biconcave for reception of occipital lobes of head, bituberculate at middle; calli feebly produced. Median suture extending about two-thirds the distance to transverse suture; disks of prescutum and scutum with numerous, rather uniformly distributed, recumbent, short setae, which become longer (though still short) anteriorly; longer, strong setae present laterally. Scutellum with four macrosetae. Underside rather uniformly, densely setose, the setae short, with longer, strong setae along sides and posterior margin, the latter fully emarginate at middle. *Wings.*—Costa with ten to twelve strong dorsal setae, these gradually shorter apically on basal half, the setae on apical half short; marginal setae very strong on about basal half and much more numerous than dorsal setae, becoming progressively shorter on apical half. R_1 with one very long basal macroseta (as in *Pseudostrebla*) followed by about four shorter but strong setae, followed by short setae; R_s bare; third, fourth and fifth longitudinal veins each with three or four strong, basal setae, the other setae short. *Legs.*—Densely clothed with short setae. Profemora with about nine dorsal macrosetae arranged in two rows each side and two others laterally near apex. Mesofemora with about four macrosetae on apical half of dorsal surface, two ventro-laterally on each side near apex, and a row of about eight shorter erect setae on lateral surface on basal half. Metafemora with about 19 macrosetae on dorsal, lateral, and ventral surfaces. Protibiae with about four erect macrosetae along dorsal edge, mesotibiae with five, metatibiae with six. Tarsomeres 1–4 together a little longer than the last segment (excluding the claws), which is laterally slightly compressed; tarsomere 1 slightly longer than 2–4, its ventral surface with several pairs of short but rather strong setae.

Abdomen.—Lateral lobes of tergum I+II with about 16 discal macrosetae and about a dozen short ones along the lateral margin. Dorsal connexivum bare except for four pairs of conspicuous segmentally arranged setae; lateral and ventral connexivum densely clothed with short setae of about same size; with two transverse rows, each of about four much longer setae anterior and lateral to sternum VI (?); tergum VII narrow, parallel-sided, strap-like, continuous with the supra-anal plate and bearing four minute setae arranged in two pairs, one anterior to the other, evenly spaced. Supra-anal plate very short, with a short seta on each side and four apical macrosetae. Seventh sternites oval, with about 14 setae of which three on apical margin are macrosetae.

Measurements:	BL	TL	WL	WW
Holotype female	2.12	0.80	1.76	0.82

TYPE MATERIAL: A unique holotype female (slide) from *Micronycteris nicefori* (host no. 11565), Armila (San Blas), 13 March 1963, C. O. Hand-

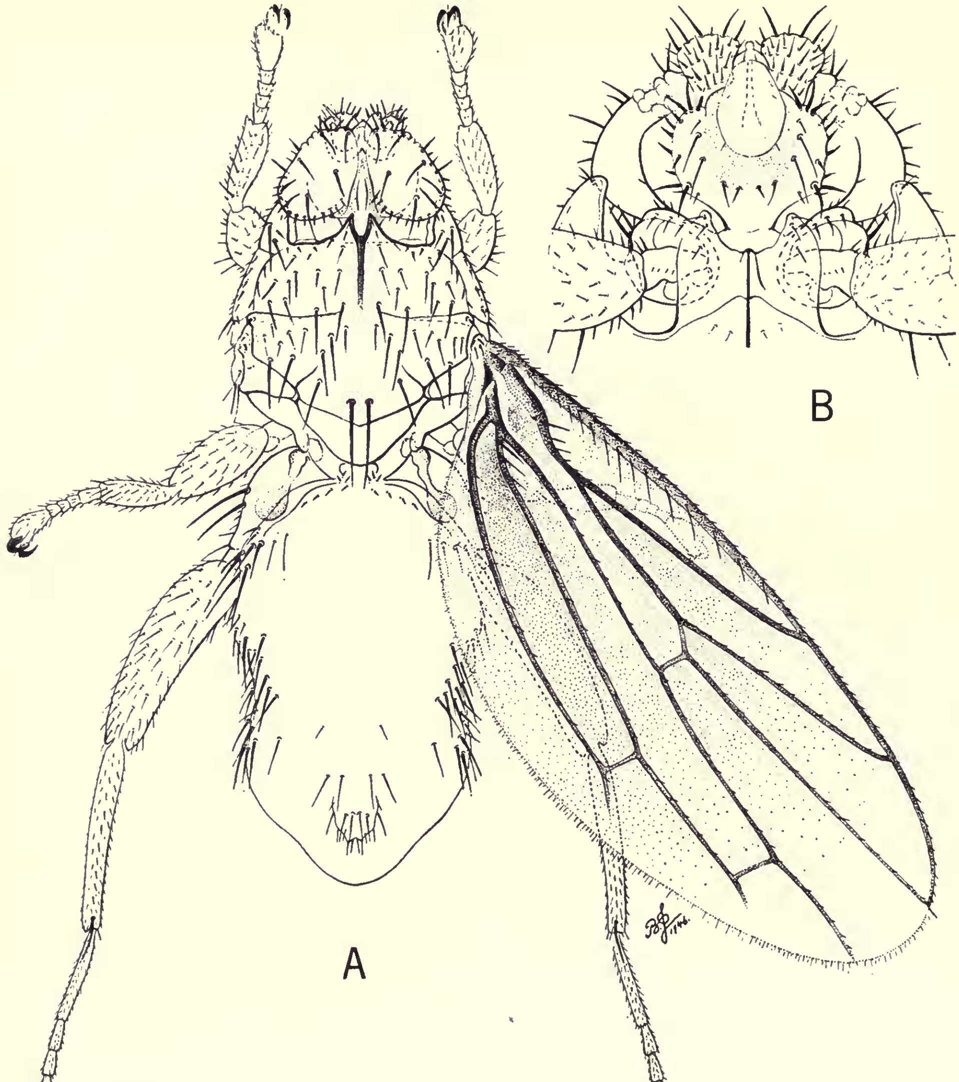

Fig. 115. *Synthesiostrebla amorphochili* Townsend, female. A, dorsal view. B, ventral view, head and anterior part of thorax. From Jobling (1947).

ley, Jr. and F. M. Greenwell. In the collection of Chicago Natural History Museum.

REMARKS: This species is named after Dr. Charles O. Handley, Jr., in recognition of his invaluable contributions to this volume.

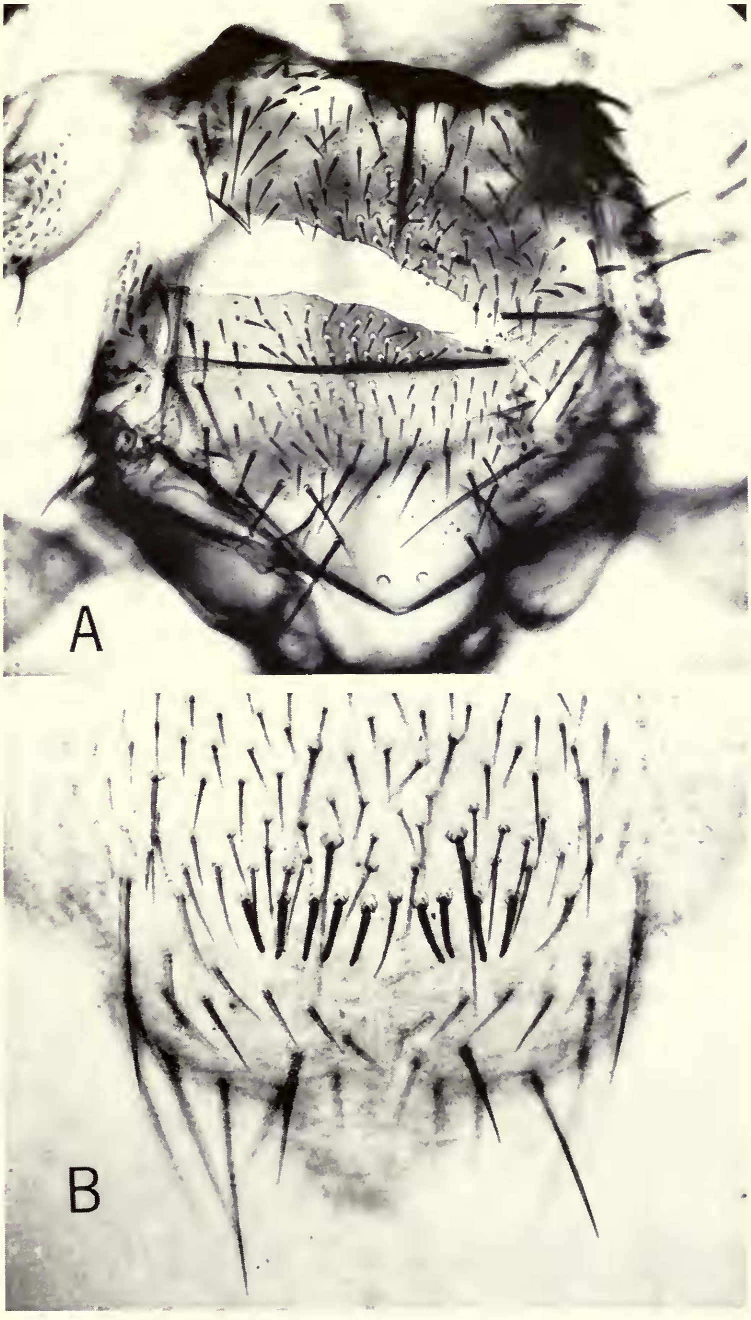

Fig. 116. *Parastrebla handleyi*, n. gen., n. sp., holotype female. A, thorax, dorsal view. B, apex of abdomen, ventral view.

Genus **Pseudostrebla** Costa Lima

Pseudostrebla Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, **5**: 23 (diagn.), 25 (keyed, as *Psaudostrebla*, sic!), 30 (cat.). Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 12 (keyed), 19. Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 654. Curran, 1935, Amer. Mus. Novit., no. 765, p. 6 (keyed). Jobling, 1936, Parasitology, **28**: 359, 367 ff., 370 (keyed); 1939, Arb. Morph. Tax. Ent., **6**, (3), pp. 269–270 (diagn., keyed). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., **3**: 417 (keyed); 1942, Bol. Ent. Venez., **1**: 86 (keyed). Jobling, 1949, Parasitology, **39**: 321 (keyed).

Type-species: *Pseudostrebla ribeiroi* Costa Lima, 1921.

Only one species of *Pseudostrebla* (*ribeiroi* Costa Lima) has been described. In our material from Panama we recognize two, one of them new. In the collections of Chicago Natural History Museum are two additional undescribed species. All are from bats of the genus *Tonatia*. It appears that each species of *Tonatia* is parasitized by a different species of *Pseudostrebla*. The Panamanian species may be separated as follows:

KEY TO PANAMANIAN SPECIES OF *PSEUDOSTREBLA*

Head: Posterior margin of occiput on each side with a feebly developed, unisetose tubercle; oral cavity about as long as or slightly longer than broad. *Legs:* hind tibiae scarcely longer than the tarsi, with five macrosetae, of which the hind two are nearly approximate and on opposite sides of tibia, middle macroseta longest, slightly more than half as long as tibia. Host: *Tonatia minuta* ...... *greenwelli* n.sp.

Head: Posterior margin of occiput on each side with a well-developed bisetose tubercle; oral cavity strongly transverse, more than twice as wide as long. *Legs:* Hind tibiae about a third again as long as the tarsi, with six macrosetae, three on basal third, two very long ones just beyond middle, the sixth near apex. Host: *Tonatia silvicola* .... *ribeiroi* Costa Lima

Pseudostrebla ribeiroi Costa Lima. Figures 117; 118, B, D.

Pseudostrebla ribeiroi Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, 5: 23–25, pl. 2, fig. 4—Brazil: Matto Grosso, from "*Tonatia amblyotes*" [sic!] (?Museu Nacional do Rio de Janeiro). Kessel, 1925, Jour. N. Y. Ent. Soc., **33**: 19. Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 656. Jobling, 1939, Arb. Morph. Tax. Ent., **6**, (3), pp. 268 (notes), 271–273 (redescr.), fig. 1A–C; 1949, Parasitology, **39**: 316 ff., fig. 2F.

A single male specimen that we have identified as this species was collected from *Tonatia silvicola* (=*amblyotis*) at Armila (San Blas), 12 March 1963, by C. O. Handley, Jr. and F. M. Greenwell. We have seen 13 additional specimens (9 lots) from the same host, from COLOMBIA, PERU, and ECUADOR. Measurements are given below to supplement Jobling's excellent figure and description. They are based on the single Panamanian specimen and a series of 11 Colombian specimens.

Measurements:	BL	TL	WL	WW
Male	2.23–2.30	0.85–0.88	1.63–1.65	0.77
Female	2.45–2.90	0.84–0.97	1.63–1.93	0.77–0.95

Pseudostrebla greenwelli Wenzel, new species. Figure 118A, C.

Similar to *P. ribeiroi* Costa Lima, but differing from that species by the characters given in the key and those noted below in the description, as well as by its much smaller size and the different male gonapophyses.

DESCRIPTION: Smaller, and less strongly pigmented and less strongly setose than *ribeiroi*. *Head*.—Transverse, but appearing less oblong than that of *ribeiroi*; laterovertices with about 10 setae, including minute setae along anterior margin (12–13 in *ribeiroi*); occipital lobes with about nine coarse setae (about 12 in *ribeiroi*) in addition to the laterally directed setae along side margins, the posterior margin of each lobe with a feeble, unisetose tubercle (in *ribeiroi* a prominent bisetose tubercle); mediovertex with four setae, two each side of middle; palpi transverse but only about a third again as

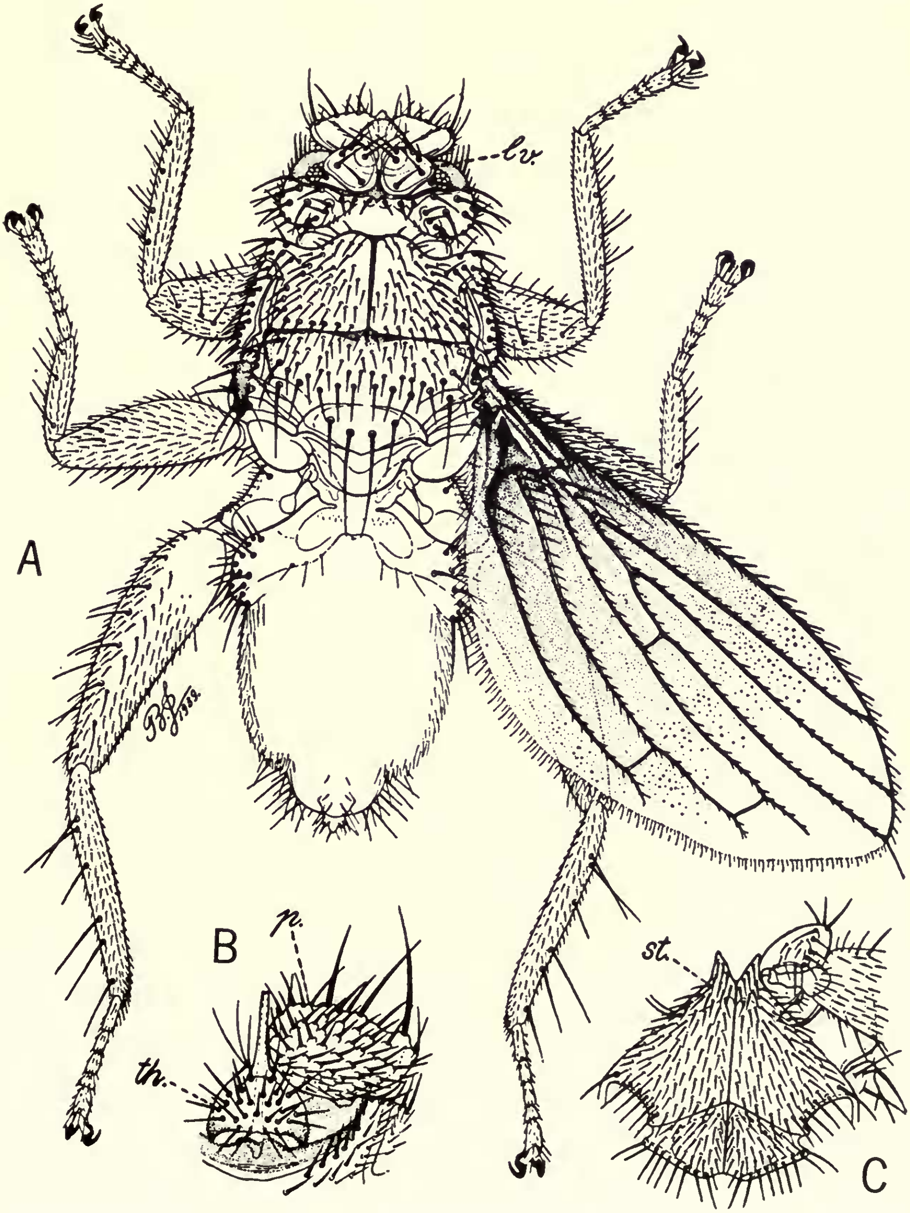

Fig. 117. *Pseudostrebla ribeiroi* Costa Lima. A, female, dorsal view. B, mouthparts. C, venter of thorax. From Jobling (1949b).

wide as long (nearly twice as wide as long in *ribeiroi*); oral cavity about as long as or slightly longer than broad (in *ribeiroi* strongly transverse, more than twice as wide as long, the theca retracted, in repose, into cavity above postgenae).

Thorax.—Mesonotum about as wide as long; prescutum and scutum microsetose throughout (in *ribeiroi*, distinctly longer than broad, scutum and baso-lateral angles of prescutum microsetose). Anterior margin of prescutum only moderately projecting at middle (strongly in *ribeiroi*); median suture extending posteriorly to transverse suture, the latter slightly sinuous and poorly defined at middle; chaetotaxy in general much as ribeiroi, but less dense and setae paler; scutum at middle with two irregular rows of setae between long antescutellar scutal setae and transverse mesonotal sutures (three in *ribeiroi*); mesepisternum (viewed from above) with coarse setae along inner and posterior margins, with very short setae laterally. *Wings.*—Very similar to those of *ribeiroi* but the coarse setae a little shorter. *Legs.*—Fore-, mid-, and hindlegs progressively longer. Inner face of pro- and metafemora covered with short setae, setae of outer face a little longer; profemora with a row of longer setae along ventro-lateral margin, a few long setae dorsally and apico-laterally; mesofemora with about two pairs of conspicuously longer setae dorso-apically, a subapical seta on each side, and five or six along ventro-lateral margin; hind femora with a row of about six longer setae on basal half of dorsal margin and a double row of six macrosetae, and another pair of macrosetae distally on each side on lateral and ventro-lateral margins. Protibiae with about five setae along dorsal margin, that are distinctly longer than the others; mesotibiae with five conspicuously longer setae along dorsal margin. Hind tibiae (fig. 118C)

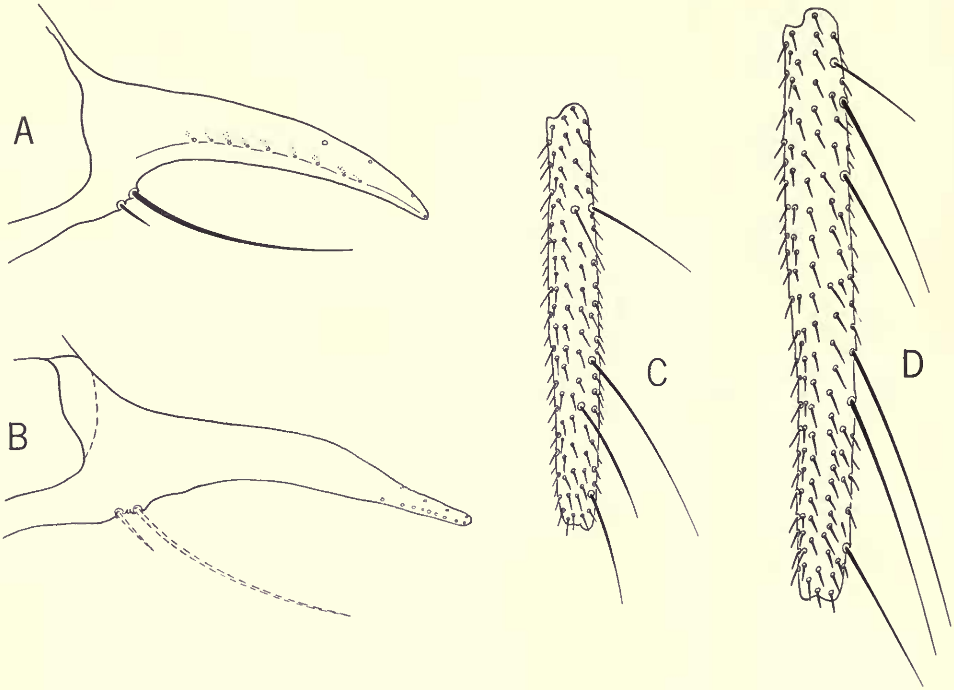

Fig. 118. A, C, *Pseudostrebla greenwelli*, new species; A, left male gonapophysis, holotype; C, hind tibia, paratype male. B, D, same structures, *P. ribeiroi* Costa Lima, from *Tonatia "amblyotis"* (= *silvicola*), Río Guapayá, La Macarena (Meta), COLOMBIA.

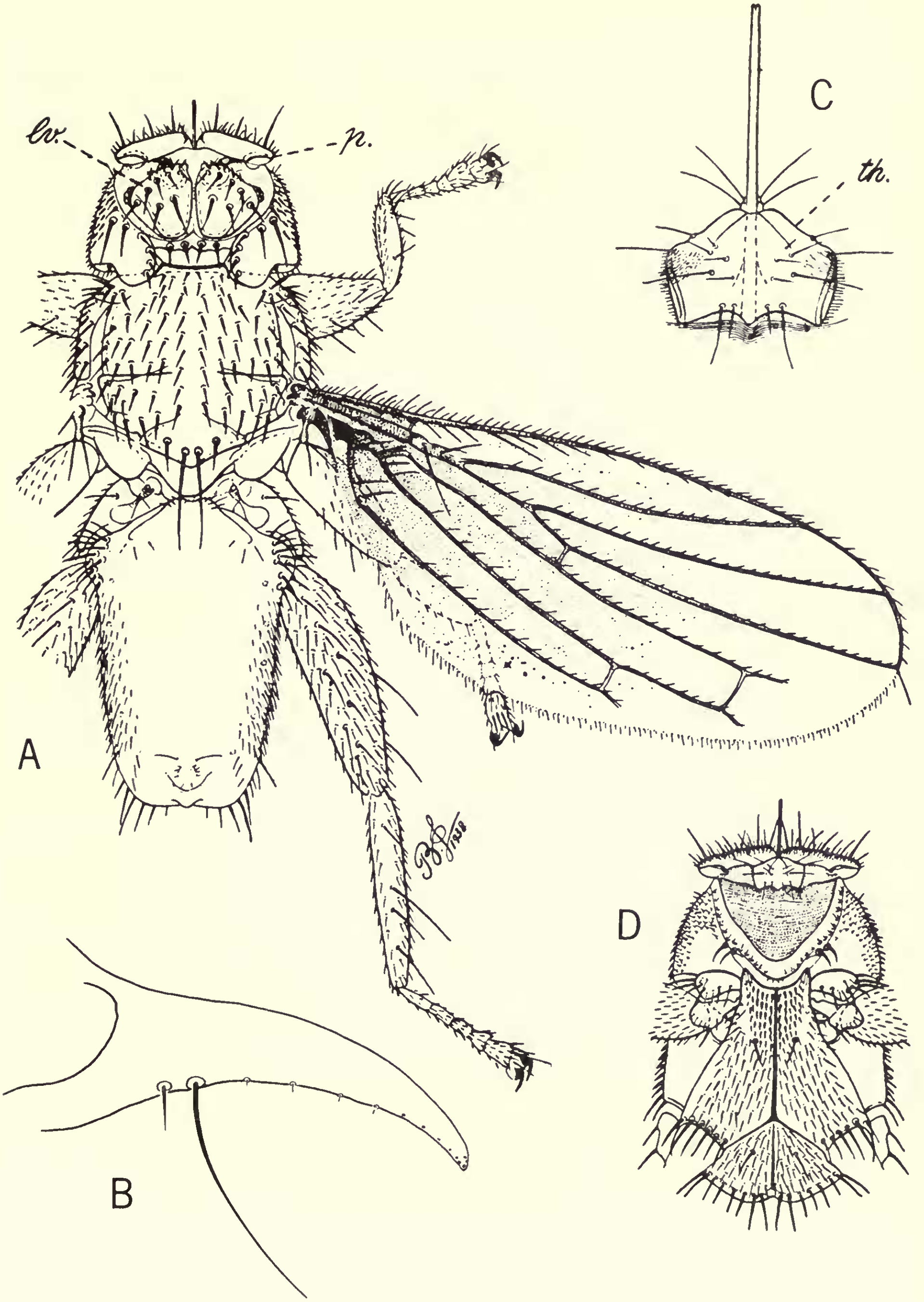

Fig. 119. *Stizostrebla longirostris* Jobling. A, female, dorsal view. B, left male gonapophysis. C, labium. D, venter of head and thorax. A, C, and D from Jobling (1949b). B, from specimen off *Tonatia* sp. (CNHM no. 87942), Los Micos, San Juan de Arama (Meta), COLOMBIA.

a little shorter than hind femora, with five macrosetae. Hind tarsi slender, about three-fourths as long as tibiae; last segment strongly, laterally compressed.

Abdomen.—Very similar to that of *ribeiroi.* Lateral lobes of tergum I+II with eight to ten long setae and eight to ten short ones (about 19 coarse macrosetae and eight to ten shorter setae in *ribeiroi*). Sternum II as in *ribeiroi* but less strongly setose. *Female:* Tergum VII and supra-anal plates apparently fused, but basal portion longer, triangular, with a pair of short setae near apex of triangle, which points anteriorly; triangular portion continuous distally with a very small crescent-like sclerite (? supra-anal plate) which bears a pair of long setae and a pair of short setae. Ventral arc flat, crescentic, non-setose. Seventh sternites triangular, inner edges parallel; with 10–12 short setae anterior to long apical setae, four of which are macrosetae (about 15 discals in *ribeiroi*). *Male:* Gonapophyses (fig. 118A) rather evenly tapered apically, with a row of microsetae on each side (abruptly tapered apically in *ribeiroi,* and without row of microsetae).

Measurements:	BL	TL	WL	WW
Male	1.70–1.76	0.58–0.59	1.24–1.26	0.60–0.63
Female	1.81	0.62	1.29	0.66

TYPE MATERIAL: Holotype male and allotype female (slides) from *Tonatia minuta* (host no. 11764), Armila (San Blas), 20 March 1963, C. O. Handley, Jr. and F. M. Greenwell. In the collection of Chicago Natural History Museum. Paratype, a male, same data but 25 March; in the collection of the United States National Museum.

Genus **Stizostrebla** Jobling

Stizostrebla Jobling, 1939, Arb. Morph. Tax. Ent., **6**: 269 (discussion), 270 (keyed), 273 (diagn.). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., **3**: 417 (keyed); 1942, Bol. Ent. Venez., **1**: 86 (keyed). Jobling, 1949, Parasitology, **39**: 321 (keyed).

Type-species: *Stizostrebla longirostris* Jobling, 1939.

This genus contains the single described species, *S. longirostris* Jobling.

Stizostrebla longirostris Jobling. Figure 119.

Stizostrebla longirostris Jobling, 1939, Arb. Morph. Tax. Ent., **6**: 273, fig. 2—Brazil, "from a bat" (Deutsches Entomologisches Institut).

In the collection of Chicago Natural History Museum is a series of eight specimens of this species, collected from *Tonatia* sp., apparently *T. silvicola,* at San Juan de Arama, Los Micos (Meta), COLOMBIA by Kjell von Sneidern. This host occurs in Panama, and it is possible that the parasite does too.

Genus **Eldunnia** Curran

Eldunnia Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479 (keyed); 1935, Amer. Mus. Novit., no. 765, pp. 5 (keyed), 6 (diagn.). Jobling, 1936, Parasitology, **28**: 357 ff. (morph.), 370 (keyed); 1939, Arb. Morph. Tax. Ent., **6**, (3), pp. 269 (discussion), 270 (keyed); 1949, Parasitology, **39**: 322 (keyed). Bequaert, 1940, Revista Acad. Colomb. Cienc. Exact., Fis. y Nat., **3**: 417 (keyed); 1942, Bol. Ent. Venez., **1**: 84 (keyed).

This monotypic genus is unique in having a postgenal ctenidium of only about 18 spines, limited to the underside of the head. The male genital apparatus is also distinctive. In addition to characters given by Curran, the following may be added:

Head.—Laterovertices transverse, without dark lines or sutures. Eyes small, with six facets. Occipital lobes and postgenae forming prominent lateral lobes which fit into deep concavities on anterior margin of thorax. Postvertex a sclerotized transverse strip which bears setae. Underside of head on each side of oral cavity with a pale oval area like that of *Pseudostrebla* and *Parastrebla*. *Legs.*—Hind tibiae with a subapical seta that is distinctly stronger than the others. *Abdomen.*—*Female:* Tergum VII feebly sclerotized, transverse. Seventh sternites triangular. Cerci free, ventral arc feebly sclerotized. *Male:* Cerci free, without apodemes that extend to surstyli. Gonapophyses (fig. 121) short, strongly narrowed distally, with several pairs of ventral setae; aedeagus blade-like, but strongly narrowed apically, not coiled at base.

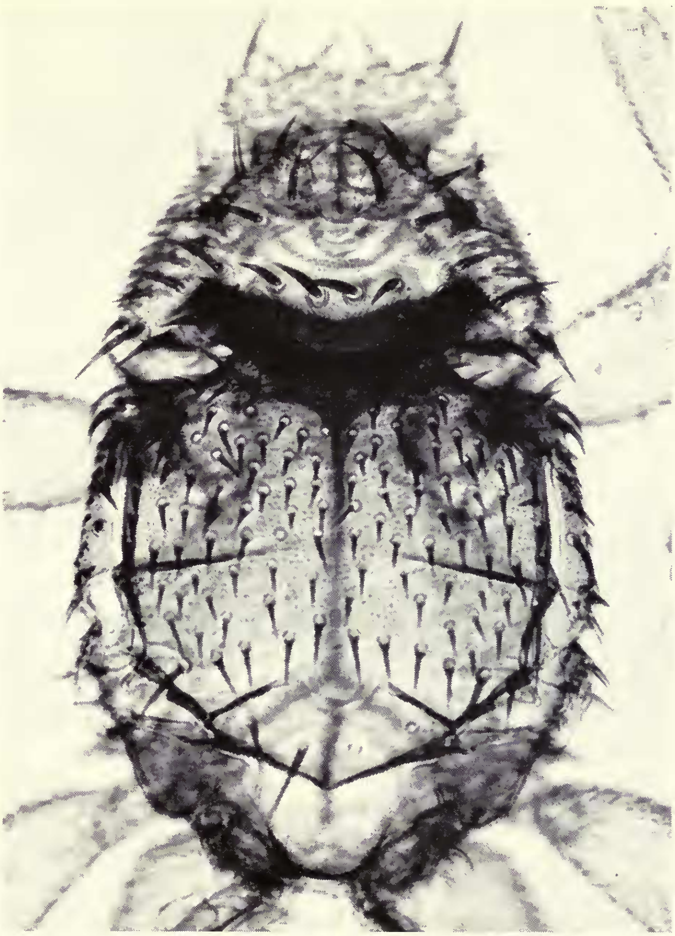

Fig. 120. *Eldunnia breviceps* Curran. Head and thorax, dorsal view, male from *Lonchophylla robusta* (no. 12213), Puerto Obaldía (San Blas).

Its very distinct male genital apparatus notwithstanding, *Eldunnia* appears to share more characters, especially of head structure, with *Pseudostrebla* and especially *Stizostrebla,* than with any other genera. It does not appear to be closely related to the genera which we regard as Streblinae.

Eldunnia breviceps Curran. Figures 39C, 120, 121.

Eldunnia breviceps Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479; 1935, Amer. Mus. Novit., no. 765, p. 6 (descr.), figs. 7, 9—Chilibrillo Caves, Panamá, from *Lonchophylla robusta* (American Museum of Natural History). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 418. Jobling, 1949, Parasitology, 39: 316 ff., fig. 2B.

Excepting the scutellum, the mesonotum of this remarkable species is covered with microsetae (fig. 120).

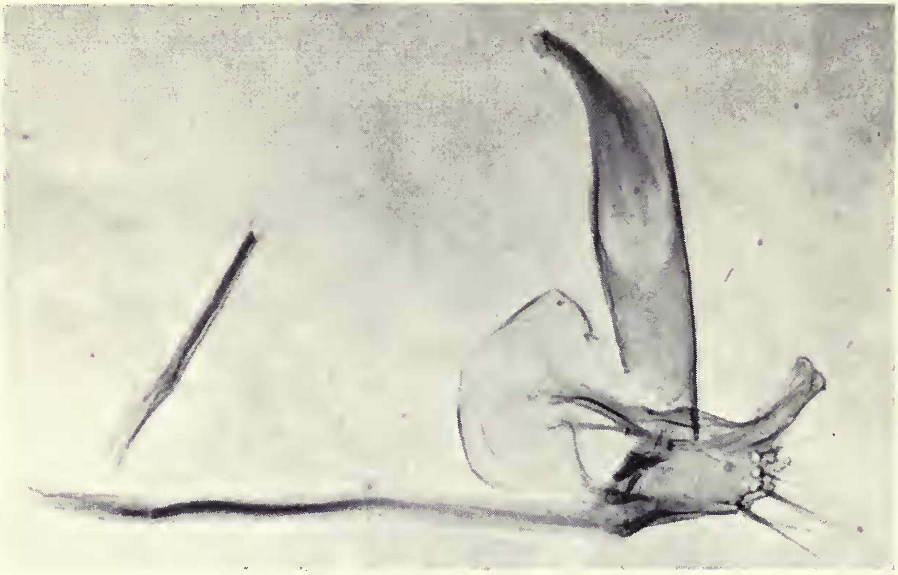

Fig. 121. *Eldunnia breviceps* Curran. Male genital apparatus, left lateral view. Same data as for specimen in fig. 120.

Measurements:	BL	TL	WL	WW
Male	1.32–1.47	0.49–0.51	1.10–1.18	0.49–0.60
Female	1.26–1.70	0.49–0.52	1.25–1.37	0.60–0.66

PANAMANIAN MATERIAL EXAMINED: In addition to the type and paratype, we have examined 18 specimens in 11 lots (12 bats), from *Lonchophylla robusta* as follows: holotype female, Chilibrillo Caves, Chilibre (Panamá), 30 January 1931, L. H. Dunn [AMNH], and the paratype, same data but 9 March 1933 [MCZ]; 1, same locality, 27 March 1958, GML; 5 (3 bats), Almirante (Bocas del Toro), 23 and 31 January 1960; 4 (2 bats), Isla Bastimentos (Bocas del Toro), 30 January and 1 February 1963; 4 (3 bats), Buena Vista caves (Colón), 15 September and 19 November 1959; 2 (2 bats), Armila (San Blas), 14 March 1963, C. O. Handley, Jr. and F. M. Greenwell; 2 (1 bat), Puerto Obaldía (San Blas), 4 April 1963, Handley and Greenwell.

REMARKS: This species is known only from Panama. It appears to be restricted to *Lonchophylla robusta,* though it is possible that it may occur on other species of the genus. None were taken from the few specimens of *Lonchophylla mordax* and *L. thomasi* that were collected in Panama. Of approximately 55 specimens of *L. robusta* that were examined, only 11 (20%) were positive for *E. breviceps*. In only one instance were more than two flies collected from a single host.

Although Curran (1935) refers to page 479 of the Fam. Gen. N. Am. Dipt. as the original citation for *E. breviceps*, there is a question in our minds as to whether or not this (1934) usage was a *nomen nudum*. The genus *Eldunnia* was keyed out, and *E. breviceps* was given in parentheses as the included species. Because the paratype lacks the abdomen, its sex is unknown.

Subfamily **Streblinae**

As defined by Jobling (1936), the subfamily Streblinae would include the following genera: *Anastrebla* (= *Strebla* auct.), *Strebla* (= *Euctenodes* Waterhouse), *Metelasmus, Paraeuctenodes, Pseudostrebla, Parastrebla,* n. gen., *Stizostrebla,* and *Eldunnia.* Jobling characterized the subfamily on the basis of shape and width of the head, shape and position of the palpi, and shape and relative size of the mesonotum.

The palpi of *Pseudostrebla, Parastrebla,* and of *Stizostrebla* and *Eldunnia* exhibit a wide range of shape and width, including that (e.g., *Pseudostrebla greenwelli* n.sp.) typical of Trichobiinae. In none of these are they modified to form a shield-like front as in the other genera assigned to the Streblinae by Jobling. The other characters, too, vary. They seem to represent specializations toward a polyctenoid body form, and probably have evolved independently at least a couple of times.

The ventral accessory setae of the male gonapophyses in *Pseudostrebla* and *Stizostrebla* are inserted posterior to the macrosetae, as in the *uniformis, longipes,* and *dugesii* groups of *Trichobius* and in the genera *Speiseria, Noctiliostrebla, Aspidoptera, Mastoptera, Exastinion* and *Paradyschiria.* The male of *Parastrebla* is unknown, but we predict that it will be of this type. In *Strebla, Anastrebla, Paraeuctenodes,* and *Metelasmus,* the accessory setae are anterior to the macrosetae, as in the *major-sparsus* and *caecus* groups of *Trichobius,* and in the genera *Megistopoda, Paratrichobius, Neotrichobius, Joblingia,* and *Anatrichobius.* These and some other characters, including female genital structure, appear to reflect natural groupings. If this is so, then the Streblinae of Jobling include convergent types. Until the relationships of the genera can be investigated more thoroughly, we restrict the Streblinae to those genera which have a complete postgenal ctenidium, which extends around the side of the head to the dorsal surface. The relationships of *Eldunnia* are puzzling. The male genital apparatus is strikingly different from that of any other New World Streblidae. However, the structure of the head appears to relate it to *Stizostrebla* and *Pseudostrebla.*

In the following section, we have used some special terms which apply only to the Streblinae. The laterovertices are divided into two or more distinct areas by dark, internal lines or ridges. The area behind the eye is often set off separately by such an internal ridge and bears a single seta.

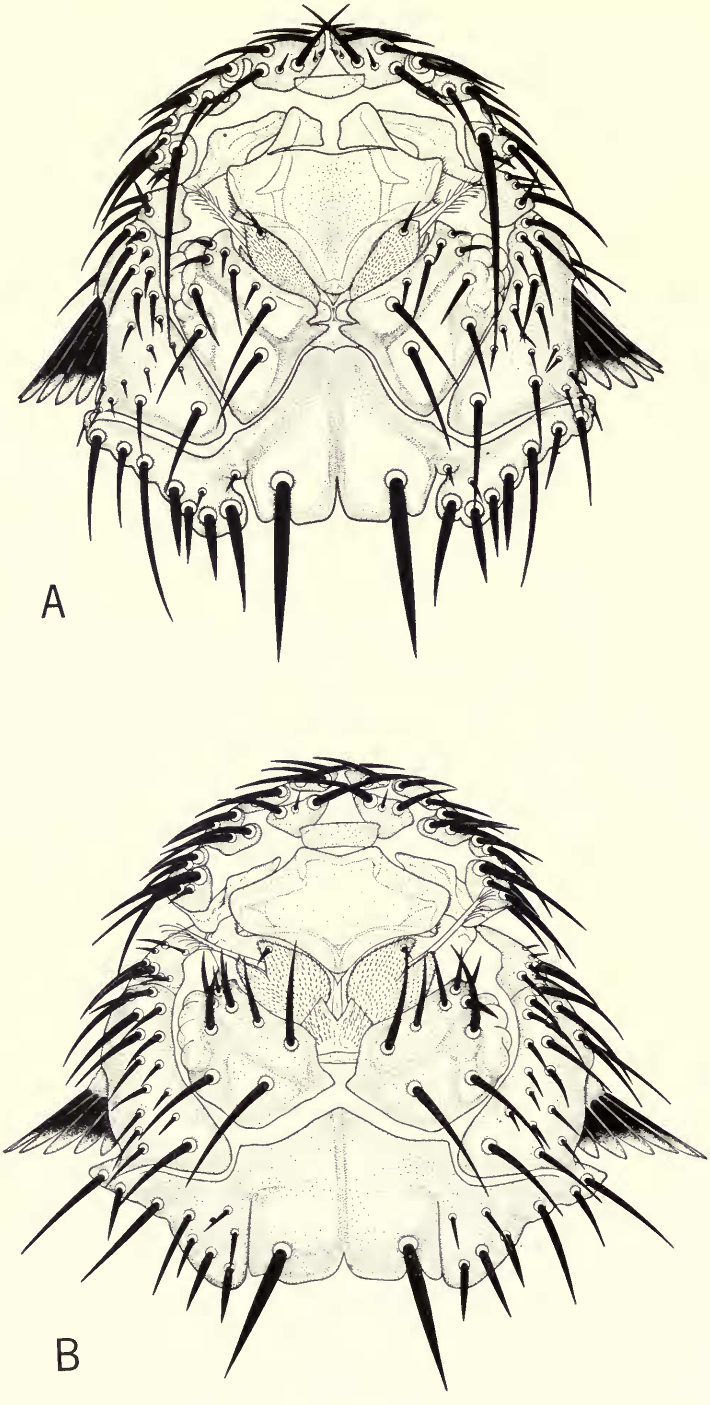

Fig. 122. Dorsum of head. A, *Strebla carolliae*, new species (composite drawing from several specimens off *Carollia p. azteca*, from localities in Panama). B, *Strebla hertigi*, new species, from *Phyllostomus h. panamensis* (no. 4651), Chepo Road (Panamá).

We have called this area the "postocular sclerite." Behind the anterior margin of the prescutum on each side, extending inwardly from the spiracle is a row of stout bristles of variable number, which we call the "epaulets" (fig. 134). Farther behind on each side of the prescutum is an arcuate row of setae, which are usually conspicuously longer than the other discal prescutal setae. We call these the "prescutal arc" of setae (fig. 134).

We have called the underside of the head, anterior to the ctenidium, the "ante-ctenidial area." Its length is measured along the mid-line between the anterior margin of the ctenidium and the anterior margin of the palpi; its width is measured between the lateral margins of the postgenae, in front of the ctenidium. Measurements of body length were made from the anterior margin of the palpi, rather than of the frontoclypeus, as was done for the other Streblidae.

Genus **Strebla** Wiedemann
(= *Euctenodes* Waterhouse), *new synonymy.*

Strebla Wiedemann, 1824, Analecta Ent., p. 19; 1830, Aussereurop. Zweifl. Ins., 2: 612. Macquart, 1835, Hist. Nat. Ins., Dipt., 2: 637. Walker, 1849, List. Dipt. Ins. Brit. Mus., pt. 3, p. 1146 (part.). Kolenati, 1856 (& 1857), Parasiten d. Chiropteren, p. 46. Rondani, 1878, Ann. Mus. Civ. Stor. Nat. Genova, 12: 167. Bigot, 1885, Ann. Soc. Ent. Fr., (6), 5: 226, 232 (keyed). Williston, 1896, Man. Fam. Gen. N. Am. Dipt., 2nd ed., p. 152 (keyed). Coquillet, 1910, Proc. U. S. Nat. Mus., 37: 609.

Euctenodes Waterhouse, 1879, Trans. Roy. Ent. Soc. Lond., **1879**: 310 (with *E. mirabilis* Waterhouse, as type-species). Bigot, 1885, Ann. Soc. Ent. Fr., (6), **5**: 226 (discuss.), 233 (keyed). Speiser, 1900, Arch. Naturg., **66A**, Bd. I, pp. 41, 42, 63, 66 (keyed). Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, **5**: 26 (keyed), 32 (cit.). Kessel, 1924, Parasitology, **16**: 406–409 (char.); 1925, Jour. N. Y. Ent. Soc., **33**: 13 (keyed), 30 (char., key to spp.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 654. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 479 (keyed); 1934, Bull. Amer. Mus. Nat. Hist., **66**: 522 (keyed); 1935, Amer. Mus. Novit., no. 765, p. 5 (keyed). Jobling, 1936, Parasitology, **28**: 355 ff. (morph., syst. pos.), 370 (keyed). Pessôa and Guimarães, 1937, Ann. Fac. Med. São Paulo, **12**: 255 ff. (comp. notes). Jobling, 1939, Arb. Morph. Tax. Ent., **6**: 269 (discuss.), 270 (keyed). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., **3**: 417 (keyed); 1942, Bol. Ent. Venez., **1**: 86 (keyed). Schuurmans-Stekhoven, Jr., 1951 (& 1941?), Beiträge Fauna Perus, **3**: 96. Jobling, 1949, Parasitology, **39**: 322 (keyed). Hoffmann, 1953, Mem. Congr. Cient. Mex., **7**: 178 (keyed), 188 (records). Maa, 1965, Jour. Med. Ent., **1**: 386.

Type-species: *Hippobosca vespertilionis* Fabricius, 1805.

Wiedemann (1824, p. 19) based his genus *Strebla* on *Hippobosca vespertilionis* Fabricius. He also gave a short description and figure of the type specimen of *vespertilionis*, and indicated its location as "In Museo Regio Havniensi." His original figure (in color) did not show setae on the hind legs. The dark structures he figured at the basal angles of the head (and later interpreted to be eyes) are the dorsally curved ends of the ctenidium. The presence of the ctenidium and the shape of the thorax clearly show the insect to be a member of the Streblinae. The relatively short hindlegs indicate, however, that the insect is a species of *Euctenodes* Waterhouse, not of *Strebla*, Speiser (1900), Kessel (1924) and later authors.

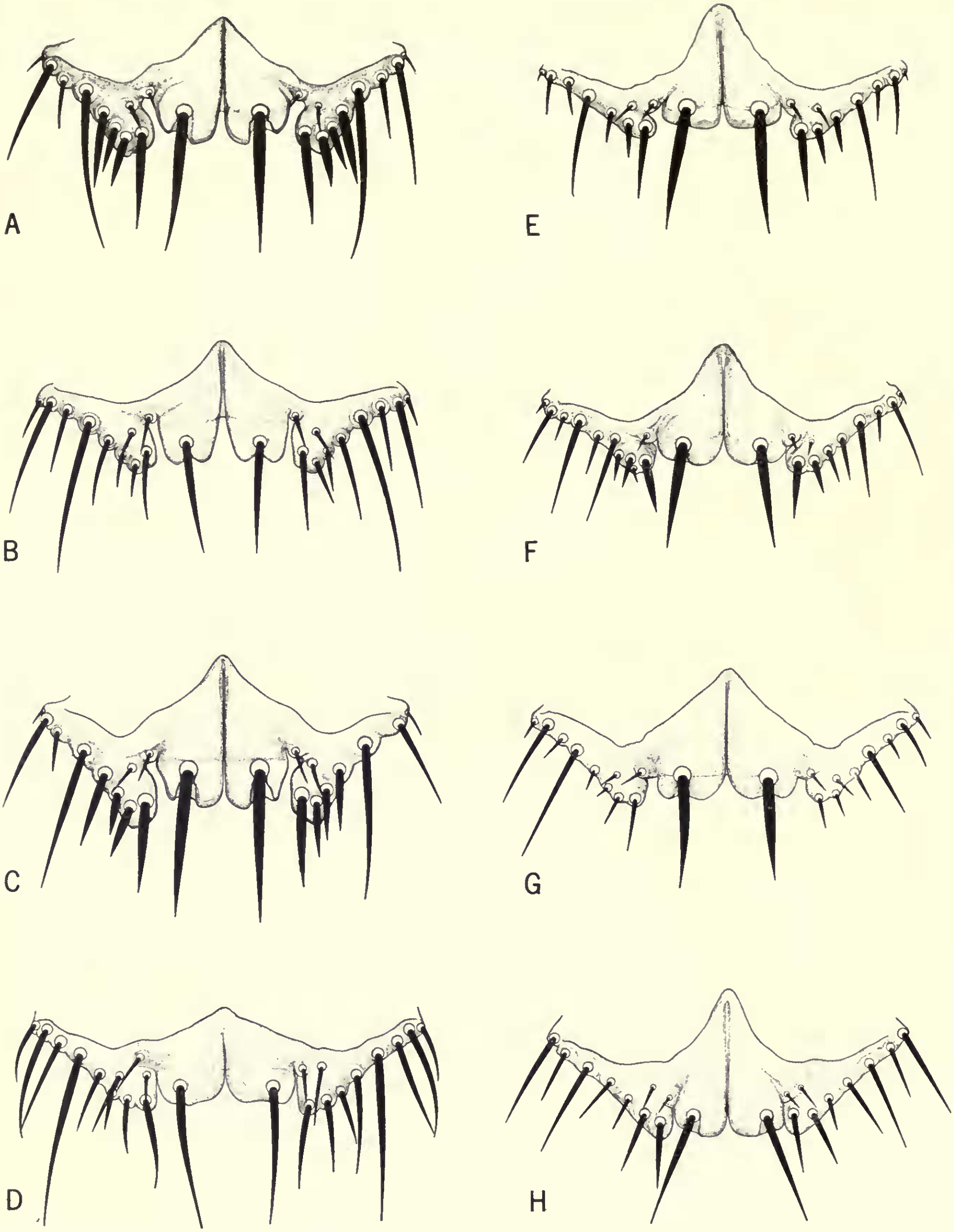

Fig. 123. Postvertex and occipital plates (of head) of species of *Strebla*. A, *S. mirabilis* (Waterhouse) from *Phyllostomus h. panamensis* (no. 4138), Natural Bridge, Madden Dam (Canal Zone). B, *S. vespertilionis* (Fabricius), from *Desmodus r. murinus* (no. 5236), Red Tank (Canal Zone). C, *S. kohlsi*, new species, from *Tonatia s. silvicola* (CNHM nos. 69897–99), Cauca Valley above Cáceres, Puri (Antioquia), COLOMBIA. D, *S. galindoi*, new species, paratype. E, *S. alvarezi*, new species, from *Saccopteryx bilineata* (no. 4659). F, same, from *Saccopteryx bilineata*, Finca Santa Cristina, (Escuintlas), GUATEMALA. G, *S. altmani*, new species, paratype from *Lonchorhina aurita*. H, *S. hoogstraali*, new species, from *Tonatia minuta* (no. 9162).

In 1830, Wiedemann added his interpretation and description of the "eyes" and slightly altered the illustration (now black and white) to change the wing somewhat and to add conspicuous setae on the hind tibiae. Macquart's (1835) figure is copied from this. Wiedemann again referred to the specimen as being in the Copenhagen Museum and it is assumed that the revised figure, too, was based on the type. Poor though the figure is, the illustration of the hind tibiae clearly shows the fly to be a species of *Euctenodes*, since the species regarded as *Strebla vespertilionis* by Speiser and Kessel (loc. cit.) has elongated hindlegs and lacks metatibial macrosetae.

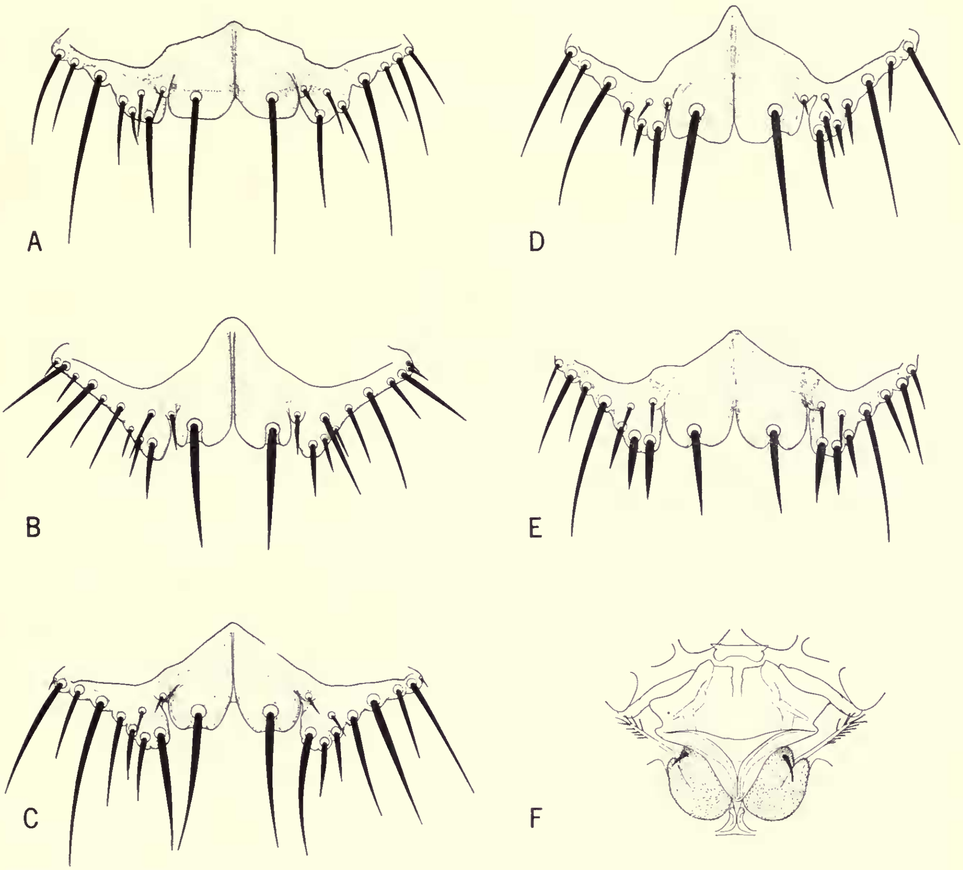

Fig. 124. A–E, postvertex and occipital plates (of head) of species of *Strebla*. A, *S. diaemi*, new species, paratype from *Diaemus youngii*, Río Raposo, COLOMBIA. B, *S. consocius*, new species, paratype from *Phyllostomus h. hastatus* (TVL nos. 1406–21) Guanapo Heights, TRINIDAD. C, *S. diphyllae*, new species, paratype from *Diphylla ecaudata centralis*, San Lorenzo, N.E. of Volcan de Jumay (Jalapa), GUATEMALA. D, *S. machadoi*, new species, holotype. E, *S. christinae*, paratype from *Phylloderma stenops* (no. 11986). F, antennae and frontoclypeus, *S. galindoi*, new species.

Thus, *Euctenodes* should be synonymized under *Strebla*, and a new name is needed for *Strebla* (not Wiedemann, 1824) of Speiser, Kessel *et al.*

The genus *Strebla* is taxonomically very difficult. In the past, a number of closely related species have been confused under *mirabilis* (Waterhouse). Only one other species was described (*tonatiae* Kessel). In our studies, we have segregated 15 species, 12 of them new. We considered it desirable to present a preliminary revision of the genus here, since 12 of the 15 species have been collected in Panama. After this study was completed, three additional new species from Colombia, Venezuela, and Surinam came to our attention, and it is likely that more will be discovered in the future. Further, some of the host data suggest that cryptic species exist which we presently are unable to separate on morphological grounds (see remarks under *S. mirabilis*). Many of the species appear to be restricted to a single host.

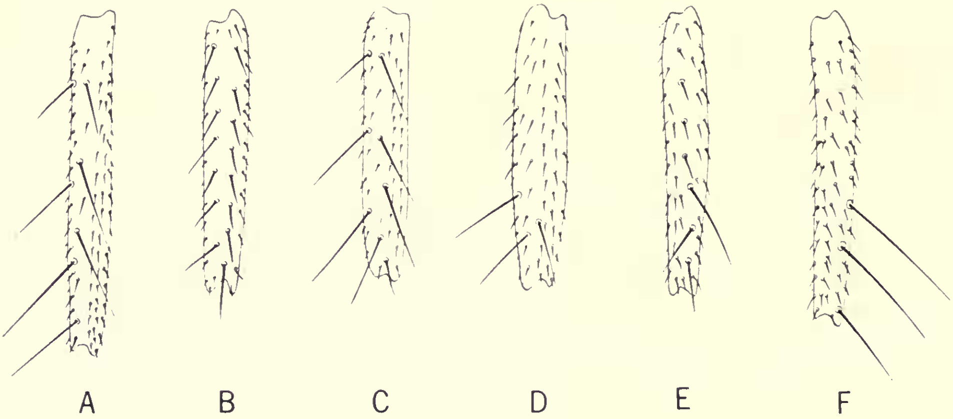

Fig. 125. Metatibiae, dorsal view. A, *Strebla consocius*, new species. B, *S. vespertilionis* (Fabricius). C, *S. diaemi*, new species. D, *S. galindoi*, new species. E, *S. mirabilis* (Waterhouse). F, *S. hertigi*, new species.

KEY TO THE SPECIES OF *STREBLA*

1. Frontoclypeus entire (fig. 122B). The second, anterior pigmented mesonotal suture lacking or indistinct (fig. 127B) 2
   Frontoclypeus with a pair of apical detached plates (fig. 122A) or with an unsclerotized median suture (fig. 124F). Second anterior pigmented mesonotal suture usually distinct, as in fig. 134, though absent in *christinae* n.sp. 6
2. Upper edge of posterior tibiae with two or three macrosetae (fig. 125D–F). Anterior margin of postvertex as in fig. 122B. Eyes consisting of a single row of about four facets. Hosts: *Phyllostomus* spp. ....*hertigi* n.sp.
   Upper edge of posterior tibiae with six to eight macrosetae (fig. 125A–C) 3
3. Anterior margin of postvertex forming an obtuse angle (fig. 124A). Prescutum (fig. 127A), anterior to the transverse mesonotal suture, broader than long; with a row of short bristles extending across entire width behind the anterior margin. Host: *Diaemus youngii* ....*diaemi* n.sp.
   Anterior margin of postvertex forming an angle less than or only slightly greater than 45° (figs. 123H, 124B). Prescutum, anterior to the transverse suture, longer than broad; short, stout bristles near anterior margin limited to a group on each side, near the anterior angles (figs. 128, 129) 4

4. Bristle at apex of third longitudinal vein only slightly larger and stronger than the preceding "erect" setae. Angle formed by the anterior margin of the postvertex about equal to or slightly greater than a right angle (fig. 124B). Eyes small but distinctly faceted. Host: *Phyllostomus hastatus* ...*consocius* n.sp.

Bristle at apex of third longitudinal vein a strong and conspicuous macroseta (fig. 126) which is at least twice as long as the preceding erect setae. Eyes consisting of a single hyaline lens, facets indistinguishable. Angle formed by the anterior margin of the postvertex conspicuously less than a right angle (fig. 123H). Hosts: *Tonatia* spp. 5

5. Mesonotum (fig. 129B), more sparsely setose, the prescutum with only about 25–28 setae on each side behind the epaulets; scutum laterally with two irregular rows of setae between the antescutellar row and the transverse mesonotal suture; setae of antescutellar row subequal. Host: *Tonatia minuta*........ ....*hoogstraali* n.sp.

Mesonotum (fig. 129A), more densely setose, the prescutum with about 42–46 setae on each side behind the epaulets; scutum, toward the sides, with three irregular rows of setae between the antescutellar row and the transverse suture; some of the lateral setae of antescutellar row distinctly longer than the median ones. Host: *Tonatia brasiliensis* ....*tonatiae* (Kessel)

6. Frontoclypeus with a median unsclerotized suture (fig. 124F). Anterior margin of postvertex as in fig. 124B; setae of postvertex and occiput long and slender. Host: *Tonatia bidens* ....*galindoi* n.sp.

Frontoclypeus with a pair of apical detached plates (fig. 122A) 7

7. Upper edge of posterior tibiae with two rows of setae which are conspicuously longer than the others, the apical ones longest 8

Upper edge of posterior tibiae either with a single row of longer setae of which the apical two or three are macrosetae or with only two or three subapical macrosetae that are distinctly longer than other tibial setae 10

8. Eyes consisting of a single elongate hyaline lens. Anterior margin of postvertex subacuminate (fig. 124D). Mesonotal chaetotaxy as in fig. 131B. Host: *Micronycteris minuta* ....*machadoi* n.sp.

Eyes multi-faceted. Anterior margin of postvertex not thus 9

9. Second or anterior transverse mesonotal suture absent. Mesonotal chaetotaxy as in fig. 131A. Postvertex as in fig. 124E, the spinelets relatively short and stout, as are the inner three spinelets of occiput on each side. *Female:* Tergum VII with two pairs of setae. Anterior margin of ventral arc of terminal cone produced as a broad rounded lobe (fig. 44A). *Male:* Gonapophyses (in lateral view) strongly curved. Host: *Phylloderma stenops* ....*christinae* n.sp.

Second or anterior transverse mesonotal suture present; mesonotal chaetotaxy as in fig. 132. Postvertex as in fig. 123B, the spinelets more slender, as are the inner three occipital spinelets on each side. *Female:* Tergum VII typically with three pairs of setae. Anterior margin of ventral arc not produced. *Male:* Gonapophyses (lateral view) only very feebly curved, nearly straight. Host: *Desmodus rotundus* ....*vespertilionis* (Fabricius)

10. Anterior margin of postvertex broadly blunt (fig. 122A). Hosts: *Carollia* spp. ....*carolliae* n.sp.

Anterior margin of postvertex much more strongly rounded, or angulate 11

11. Inner occipital setae fine, bristle-like, not spinelets (fig. 123G). Hosts: *Lonchorhina aurita, Macrophyllum macrophyllum* ....*altmani* n.sp.

At least one or two, usually three or four of inner occipital setae on each side are spinelets 12

12. Anterior margin of postvertex as in fig. 123E, F. Prescutum (fig. 137B) with only two irregular transverse rows of setae laterally between the transverse mesonotal suture and the anterior suture ....*alvarezi* n.sp.

Anterior margin of postvertex otherwise (figs. 123A, C; 124C). Prescutum (figs. 133, 134) with at least three irregular transverse rows of setae laterally between the transverse mesonotal suture and the anterior suture 13

13. Prescutum (fig. 133) densely setose anteriorly; median discal setose area extending anteriorly nearly to margin, the antero-lateral setose areas (anterior to arcs) extending along sides nearly to epaulets. Postvertex and occiput as in fig. 124C, their setae strong, but not stout spines or spinelets. Host: *Diphylla ecaudata* ....*diphyllae* n.sp.
    Prescutum (fig. 134) sparsely setose anteriorly; median discal setose area extending only to about middle, distinctly separated from antero-median paired setae; area behind epaulets along lateral margins bare 14
14. Head elongate, the ventral ante-ctenidial area only slightly wider than long (24:22). Detached frontoclypeal plates distinctly longer than wide. Host: *Tonatia silvicola* ....*kohlsi* n.sp.
    Head short; ventral ante-ctenidial area nearly half again as wide as long (59:41) Hosts: *Phyllostomus hastatus panamensis*, (?) *Trachops cirrhosus*........... ....*mirabilis* (Waterhouse)

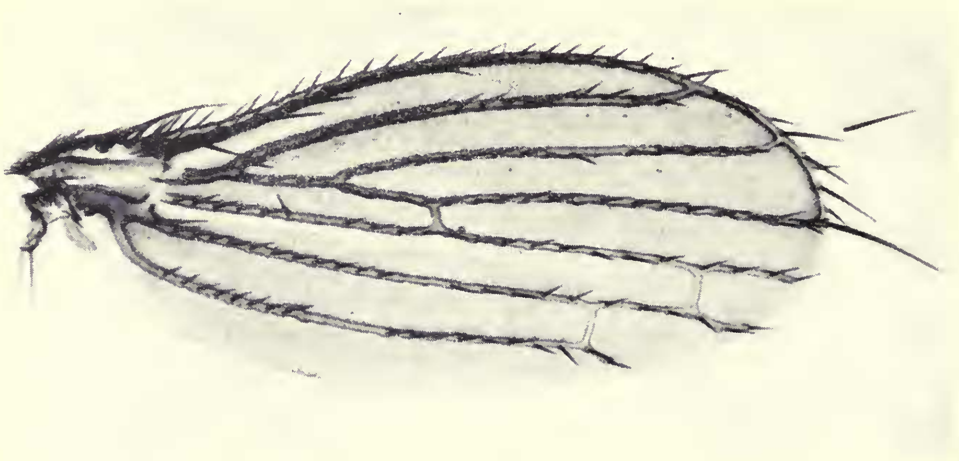

Fig. 126. Wing, *Strebla hoogstraali*, new species, male paratype from *Tonatia silvicola* (no. 9102), Las Palmitas (Los Santos).

Strebla hertigi Wenzel, new species. Figures 122B, 125F, 127B.

A very distinctive species not closely related to any other, that is easily recognized by the following combination of characters: frontoclypeus entire (without apical detached plates), eyes consisting of only four or five ocelli in a row; metatibiae with only two or three macrosetae; setae and macrosetae of occiput and spines of postvertex comparatively short; dorsal plate of postgenae with a postero-lateral emargination; postvertex long, subquadrate.

DESCRIPTION: *Head* (fig. 122B).—Frontoclypeus without detached apical plates. Anterior plate of laterovertices with five to six setae; postocular sclerite distinct. Chaetotaxy of head as illustrated, except that long, outer setae of occiput are a little more slender than shown. Postero-lateral margin of dorsal sclerite of postgenae emarginate for reception of ctenidium. Eyes with four or five facets in a single row. Ventral ante-ctenidial area about as wide as long (24:23). Postvertex long, its anterior margin obtusely angulate.

Thorax (fig. 127B).—Prescutum without a second pigmented suture; epaulets consisting of five or six setae which extend across anterior margin to median pair; prescutal setae extending anteriorly to anterior margin; arcuate row of long setae present but not conspicuously differentiated. Setose area posterior to arc consisting of about four irregular transverse rows at middle, three toward sides. Antescutellar scutal setae mostly subequal, not distinctly longer laterally, except for long macroseta at extreme lateral margin; two rows of scutal setae in addition to antescutellars, anterior half of scutum bare toward sides. *Wings.*—R_s approximately a third again as long as distance from fork to *r-m* (25:17.5). All veins setose to base, excepting the sixth longitudinal. *Legs.*—Protibiae with five exceptionally long macrosetae, mesotibiae with three. Hind tibiae (fig. 125F) apically with three macrosetae, the distal one less than half as long as the basal one. First segment of hind tarsi with a median row of heavy plantar bristles, one or two outwardly near base, one inwardly at apex and several fine ones anterior to this; plantars of following segments minute.

Abdomen.—Anterior face of tergum I+II with three short setae; inner dorsal margin with three to five setae, two very fine. *Female:* Tergum VII with two pairs of macrosetae; the second, posterior pair more than half as long as anterior pair, sometimes with a supernumerary. Supra-anal plate with four long, apical macrosetae and a pair of short but well-developed basal setae. Seventh sternites with 13–16 setae consisting of four macrosetae (two very long), three to five intermediate setae, and four to nine short setae. Ventral arc triangularly produced anteriorly, with a single pair of setae. *Male:* Hypopygium dorso-laterally on mid-third with a macroseta and one or two shorter setae; dorso-apical margin with six to eight macrosetae; a long apical macroseta below these on each side. Gonapophyses nearly straight, slightly sinuate above, the macroseta inserted at about basal fourth. Sternum V at middle with two transverse rows of setae in addition to marginal setae.

Measurements:	BL	TL	WL	WW
Male	2.56–3.13	0.85–0.88	1.87–1.95	0.84–0.93
Female	2.56–3.08	0.88–0.93	1.87–2.14	0.91–0.96

TYPE MATERIAL: Holotype male and allotype female (slides) from *Phyllostomus hastatus panamensis* (host no. 4650), hollow tree, Chepo Road (Panamá), 8 October 1959, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes: PANAMA.—From *P. h. panamensis:* 38 (12 bats), same data as the holotype; 1 (20 bats), Chilibrillo Caves (Panamá), 17 July 1959 and 1, 28 October 1959; 1, Tapia (Panamá), 25 July 1923, J. P. Chapin [MCZ]; 1, Fort Sherman (Canal Zone), 6 April 1960; 3 (2 bats), Natural Bridge, Madden Dam (Canal Zone), 31 August 1959; 2, Almirante (Bocas del Toro), 29 January 1960. From *Phyllostomus d. discolor:* 1, Río Tuira (Darién), 10 March 1958, P. Galindo [GML]; 3, Río Mandinga (San Blas), 18 and 29 May 1957, P. Galindo [GML]; 1, Armila (San Blas), 1 April 1963, C. O. Handley Jr. and F. M. Greenwell. From *Lasiurus egregius* (mist net): 1, Armila (San Blas), 23 February 1963, Handley and Greenwell. From *Artibeus j. jamaicensis:* 1, Natural Bridge, Madden Dam (Canal Zone), 31 August 1959. From *Desmodus r. murinus:* 1, Guánico (Los Santos), 26 January 1962.

COSTA RICA.—From *Phyllostomus h. panamensis:* 1, Playa del Coco, Guancaste, 20 August 1962, F. Truxal, Los Angeles County Museum. NICARAGUA.—From *Phyllostomus h. panamensis,* 5 km. N and 14 km. E of Condega: 2 (1 bat), 23 June 1964, J. Knox Jones [KU]; 8 (1 bat), 25 June 1964, J. D. Smith [KU]; 19 (1 bat), 24 June, and 10 (1 bat), 25 June 1964, T. E. Lawlor [KU]. EL SALVADOR [H. Felten, SNI].—From *Phyllostomus discolor verrucosus:* 5, Hacienda San Diego (La Libertad), 15 November 1953; 1, same data but 8 February 1953; 5, San Rafael Cedros (Cuscatlan), 7 September 1953; 496 (1 lot), "Hohle *Ceiba pentandra,* an Strasse San Salvador–Sta. Ana bei San Andres" (La Libertad), 482 meters elevation, 27 September 1953; 11, "Hohle bei Suchitoto (Cuscatlan)," 7 June 1953; From *Desmodus rotundus:* 1, "Hohle *Ceiba pentandra,* bei km. 31, Strasse San Salvador, Sta. Ana," 4 August 1953. *Without host:* 2 lots, 27 specimens. GUATEMALA.—*Without host:* 5, Patulul, April 1906. COLOMBIA.—From *Phyllostomus discolor:* 1, Cucuta, May 1940. VENEZUELA.—From *Phyllostomus d. discolor:* 1, Biological Station, Rancho Grande (Aragua), 31 August 1962, C. Machado and R. Antequera [FCUCV]. TRINIDAD (TVL unless otherwise indicated).—From *Phyllostomus discolor* [*discolor*]: 2, Alta Gracia Trace, Siparia, 20 January 1958; 31, Long Circa, Port-of-Spain, 2 August 1954; 6, Masson Hospital, Port-of-Spain, 29 October 1956; 7, Emperor Valley Zoo, Port-of-Spain, 13 and 18 March 1958; 1, Santa Cruz, 28 June 1956; 2, Port-of-Spain, C. C. Sanborn, 8 November 1954, CNHM Trinidad Zoological Field Trip (1954). BRITISH GUIANA.—*Without host:* 2, Kartabo, Bartica District, 1921, A. E. Emerson. SURINAM.—From *Phyllostomus discolor:* 3, Kaiserberg Airstrip, east of Zuid River, 12 October 1960, and 4, same locality, 12 December 1960, H. A. Beatty, CNHM Guianan Zoological Expedition, 1960–62. PERU.—From *Phyllostomus discolor:* 3, Hacienda Bogetes, Salitral (Piura), 23 April 1959, 180 meters elevation, C. Kalinowsky, CNHM Peruvian Zoological Expedition. Paratypes to be deposited in the collections listed on p. 410.

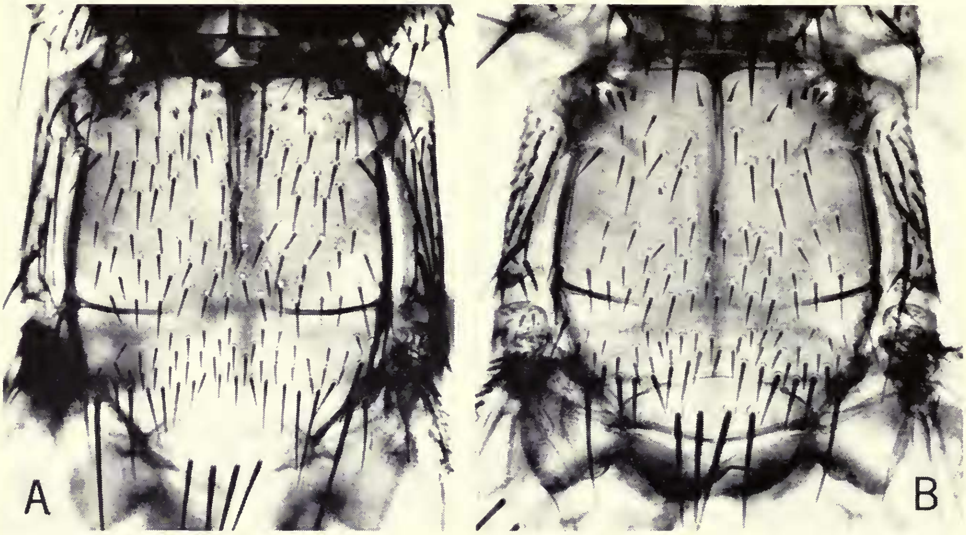

Fig. 127. Thorax, dorsal view. A, *Strebla diaemi,* new species, male paratype from *Diaemus youngi,* Río Raposo, COLOMBIA. B, *S. hertigi,* new species, male paratype from *Phyllostomus discolor,* Port-of-Spain, TRINIDAD.

OTHER MATERIAL EXAMINED: We have at hand dozens of additional lots collected in MEXICO, COSTA RICA, and NICARAGUA from *Phyllostomus discolor* *verrucosus* by J. Knox Jones [KU] and collaborators and by Fred Truxal and collaborators [LACM]. We have not yet tabulated these records.

REMARKS: This species is named in honor of Dr. Marshall Hertig, distinguished medical entomologist of the Gorgas Memorial Laboratory.

S. hertigi may occur on *Phyllostomus d. discolor* throughout most, if not all of its range; but we have seen specimens only from the tropical lowlands, from Mexico to Peru and northeastern South America. In Panama, it often occurs together with *S. mirabilis* on *Phyllostomus h. panamensis*, but perhaps only where ecological situations are favorable for its transfer to that host from *P. discolor*. Interestingly, *S. mirabilis* does not seem to occur on *P. h. panamensis* in Costa Rica and Nicaragua, but is entirely replaced by *hertigi*. For further discussion, see p. 645, and following paper, p. 683.

Strebla diaemi Wenzel, new species. Figures 124A, 125C, 127A.

Similar to *S. hertigi* n. sp., *S. consocius* n. sp., and *S. tonatiae* (Kessel) in having the frontoclypeus entire. Among these, it resembles *hertigi* in the shape of the postvertex, but differs conspicuously in having seven metatibial macrosetae (rather than two or three) and in having convex, multifaceted eyes, whereas *hertigi* has a single row of four facets. It resembles *consocius* in the metatibial setae and eyes, but differs markedly from that species in the shape of the postvertex as well as in other characters given in the key.

DESCRIPTION: *Head.*—Frontoclypeus entire, without apical detached plates. Anterior plate of laterovertices with about seven setae; postocular sclerite distinct. Dorsal surface of postgenae not emarginate laterally; posteriorly with about 15 short setae and, near inner posterior margin, a conspicuous macroseta of about same length as the long, outer occipital setae; lateral to the macroseta is a shorter seta of about same length as inner occipitals. Postvertex and occiput as illustrated (fig. 124A), but the setae usually more nearly like those shown on right side. Eyes multi-faceted and projecting, seven or eight facets visible from above. Ventral ante-ctenidial area more than half again as wide as long (29.5:18.5).

Thorax (fig. 127A).—Prescutum with one pigmented suture; epaulets consisting of eight or nine setae on each side and extending inwardly on each side to paired median setae behind anterior margin; arc of longer setae not well-defined, though the lateral setae of arc are conspicuous. About six to eight median antescutellar setae scarcely longer than the scutal setae anterior to them; on each side of these are three or four longer setae, one conspicuously longer; to each side of antescutellars are two prominent setae, one a very long macroseta. *Wings.*—All veins except sixth longitudinal, setose to base. Costa without a macroseta at apex. R_s about two and a half times as long (29:11) as distance from fork to *r-m*. *Legs.*—Pro- and mesotibiae dorsally each with eight or nine conspicuous macrosetae in a double row; metatibiae (fig. 125C) with seven macrosetae, the apical ones about as long as the first three tarsomeres combined. First segment of hind tarsus elongate, slightly longer than next three segments combined; ventrally with a median longitudinal row of five very heavy, long plantar bristles, and lateral to these, two others on basal half of outer edge and three or four slightly weaker ones along inner edge. Plantar bristles of succeeding segments very small, relatively inconspicuous.

Abdomen.—Dorsal inner margin of lateral lobes of tergum I+II with three to four setae. *Female:* Tergum VII with a pair of very long macrosetae and, posterior to these, two pairs of setae in tandem, the anterior of these shorter, the posterior pair about two-thirds to three-fourths as long as the anterior macrosetae. Supra-anal plate with four apical macrosetae and on each side, near base, one or two pairs of shorter, conspicuous setae. Seventh sternites with 12–15 setae, four to seven of these being macrosetae. Ventral arc produced anteriorly as a finger-like process, its posterior edge with eight fine setae, the two median setae much shorter than the others. *Male:* Hypopygium very long and prominent; sternum VII+VIII dorsally with two conspicuous macrosetae a little beyond middle, and medial and slightly posterior to these, two setae that are more than half as long as the macrosetae; tergum IX dorsally with a row of four macrosetae. Gonapophyses gradually tapered and curved from base to knobbed apices; sides with scattered microsetae, chiefly on apical third, a few anterior to macroseta; ventral macroseta inserted at about apical third; accessory seta minute.

Measurements:	BL	TL	WL	WW
Male	2.53–2.80	0.88–0.93	1.76–1.92	0.82
Female	2.89–3.16	0.93–0.99	1.87–1.92	0.82–0.88

TYPE MATERIAL: PANAMA.—Holotype male and allotype female (slides), from *Diaemus youngii cypselinus* (host no. 11422), Armila (San Blas), 4 March 1963, C. O. Handley, Jr. and F. M. Greenwell. In the collection of Chicago Natural History Museum.

Paratypes.—6, same data as the holotype; 4, same host and collectors, Isla Bastimentos (Bocas del Toro). COLOMBIA.—7, same host, Río Raposo (Valle de Cauca), 10 August 1962, C. J. Marinkelle and W. Thornton; 1, same host, Río Mecaya (Caqueta), 1851 meters elevation, 2 March 1952, P. Hershkovitz, CNHM Colombian Zoological Expedition (1948–52). PERU.—14, same host, Río Calleria, Colonia Calleria, "15 km. from [?Río] Ucayali" (Loreto), 8 October 1961, B. Malkin and J. S. Hurley. Paratypes in the collections of Chicago Natural History Museum; the United States National Museum; and C. J. Marinkelle, Universidad de los Andes, Bogota, Colombia.

OTHER MATERIAL EXAMINED: 2, from "bats," Orinoco River, VENEZUELA, collected by Olalla, [MCZ, det. as *mirabilis* by Bequaert].

REMARKS: The only host known for this species is *Diaemus youngii*, a vampire bat which often attacks poultry (Goodwin and Greenhall, 1961).

Strebla consocius Wenzel, new species. Figures 124B, 125A, 128.

Closely related to *S. tonatiae* (Kessel) but differing in the greater angle formed by the anterior margin of the postvertex, the convex, multi-faceted eyes (a single hyaline lens in *tonatiae*), and in not having a conspicuous macroseta at apex of costal wing vein.

DESCRIPTION: *Head.*—Frontoclypeus without apical detached plates. Anterior plate of laterovertices with six setae; postocular sclerite distinct. Dorsal surface of postgenae not emarginate laterally, posteriorly with about 10 short setae, as well as a conspicuous macroseta near inner posterior margin and lateral to it a shorter but conspicuous seta. Postvertex and occiput as illustrated (fig. 124B) but anterior margin generally a little more pointed and the festoon setae usually more like those shown on right side. Eyes relatively small, multi-faceted, about seven facets of varying sizes, visible from above. Ventral ante-ctenidial area wider than long (29:22).

Thorax (fig. 128).—Prescutum without second or anterior transverse suture; epaulets usually with five to six setae; discal setae relatively sparse, setose area not quite reaching epaulets along sides; arc of longer setae not distinguishable, though long outer seta is present. Antescutellar setae conspicuously longer than other scutals. *Wings.*—All veins except sixth setose to base. Costa without a macroseta at apex. R_5 only about a fourth longer (23:17) than distance from fork to crossvein *r-m*. *Legs.*—Protibiae with about eight conspicuously long macrosetae, mesotibiae with nine to ten. Metatibiae with six or seven conspicuously long macrosetae along dorsal edge, the apical ones longest. First segment of hind tarsus about as long as next two segments combined, the ventral surface with two irregular rows of conspicuous plantar bristles and an inner row of much shorter ones; plantars of following segments minute, inconspicuous.

Abdomen.—Inner dorsal margins of tergum I+II with five to six setae. *Female:* Tergum VII with two macrosetae and posterior and medial to them a pair of setae nearly half as long. Supra-anal plate with four apical macrosetae only. Seventh sternites with 11–12 setae, about five of these very long and coarse, one much longer than the others. Ventral arc very narrow, with two longer setae and eight minute ones along middle. *Male:* Hypopygium as in *diphyllae.* Gonapophyses heavy anteriorly, ventral margin nearly straight, the dorsal margin gradually curved to near apex where both are markedly curved, apices knobbed. Sides with scattered microsetae from apices nearly to base; ventral macroseta inserted slightly beyond middle, extending nearly to apex; accessory seta minute.

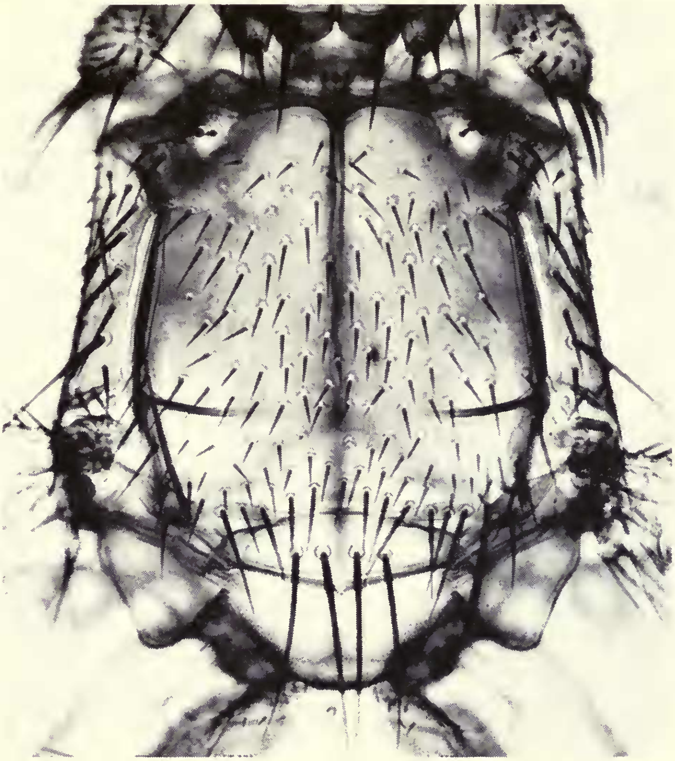

Fig. 128. Thorax, dorsal view, *Strebla consocius*, new species, female paratype from *Phyllostomus hastatus* (CNHM no. 87115), Santa Rita, Iquitos (Loreto), PERU.

Measurements:	BL	TL	WL	WW
Male	2.86–2.97	0.96–0.99	1.76–1.90	0.82–0.93
Female	3.08–3.11	0.96–1.04	1.98–2.23	0.91–0.99

TYPE MATERIAL: Holotype male and allotype female (slides), from *Phyllostomus h. hastatus* (CNHM host nos. 61915–19), cave, Guanapo Heights, TRINIDAD, Frank Wonder, CNHM Trinidad Zoological Expedition (1947). In the collection of Chicago Natural History Museum.

Paratypes: TRINIDAD.—From *Phyllostomus h. hastatus:* 9, same data as holotype; 4, same locality, 11 July 1954 and 1 same locality, 1 October 1957, T.H.G. Aitken [TVL]; 1, Tamana Cave, Mount Tamana, 20 November 1957, T.H.G. Aitken [TVL]. From *Carollia p. perspicillata:* 1, same data as the preceding. *Without host:* 5, same locality and date as the preceding. VENEZUELA.—From *Phyllostomus hastatus* subsp.: 1, San Sebastian Cave (Aragua), 2 September 1961, Carlos Bordon [FCUCV]. SURINAM (CNHM Guianan Zoological Expedition, 1960–62).—From *Phyllostomus h. hastatus:* 6, Lelydorplan (Surinam), 21 January 1962, Philip Hershkovitz; 12 (3 lots), Kaiserberg Airstrip, east of Zuid River, elevation 900 feet, 15 October to 23 November, H. A. Beatty. From *Phyllostomus* sp. (probably *hastatus*): 2, same locality and collector as the preceding, 12 October 1960. PERU (CNHM Peru Zoological Expeditions, Celestino Kalinowski).—From *Phyllostomus* sp.: 6, Mann, (Madre de Dios), 17 October 1954; 10, Santa Rita, Iquitos (Loreto), 16 October 1956. From *Trachops* sp. (!): 9, Quebrada Esperanza, Río Yauari-Mirim, Maynas (Loreto), 22 September 1957. *Without host* (removed from cloth wrappings containing numerous preserved bats): 1 each, presumably from Huajyumbe (Cuzco), 16 September 1950, and Marcapata (Cuzco), 24 August 1950.

REMARKS.—The specimen with doubtful host from Huajyumbe was resting lightly on the fur of an alcohol-preserved specimen of *Mesophylla macconelli.* The specimen from Marcapata was doubtfully associated with *Molossus rufus.* No species of *Strebla* are known to us from these host genera. The association with *Molossus* seems especially dubious. The only streblids known to us from this genus are species of the genus *Trichobius* (see *Trichobius dunni*).

S. consocius seems to be restricted to *Phyllostomus hastatus* in northeastern South America and Amazonian Peru. It probably occurs on this host elsewhere in the Amazonian region, but we are unable to verify this from the limited material collected in that region.

Strebla tonatiae (Kessel). Figure 129A.

Euctenodes tonatiae Kessel, 1924, Parasitology, 16: 411–412, figs. 7, 8—Gualaguiza, Ecuador, from *Tonatia brasiliensis* (British Museum of Natural History); 1924, Jour. N. Y. Ent. Soc., 33: 30, pl. 4, fig. 26. Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 654. Pessôa and Guimarães, 1937, Ann. Fac. Med. São Paulo, 12: 255 ff., figs. 10–12. Jobling, 1949, Parasitology, 39: 316 ff.

We have not seen the type of *S. tonatiae* (Kessel), but our Peruvian specimens agree well with Kessel's figure and with the host of *tonatiae.* The identity of the host of our Peruvian specimens has been verified by Mr. Philip Hershkovitz of Chicago Natural History Museum. The host of the type of *S. tonatiae* has not been checked.

S. tonatiae and *S. hoogstraali* n. sp. differ from all others known to us in possessing a long conspicuous macroseta at the apex of the costal wing vein. The eyes of both species consist of a single hyaline lens as in *S. machadoi* n. sp., but they differ markedly from this species in the shape of the postvertex and in having the frontoclypeus entire (without apical detached plates). They appear to be most closely related to *S. consocius* n. sp., from *Phyllostomus h. hastatus.* Though small and of nearly the same shape as in *tonatiae,* the eyes of *consocius* have distinguishable facets. Further, the postvertex is of a different shape.

Measurements:	BL	TL	WL	WW
Male	1.90	0.66	1.10	0.55
Female	2.67	0.82	1.21	0.55

MATERIAL EXAMINED: From *Tonatia brasiliensis* (host no. 75586): a male and female, Huajyumbe (Cuzco), PERU, elevation 630 meters, 23 May 1953, Celestino Kalinowski, CNHM Peru Zoological Expedition (1953–54).

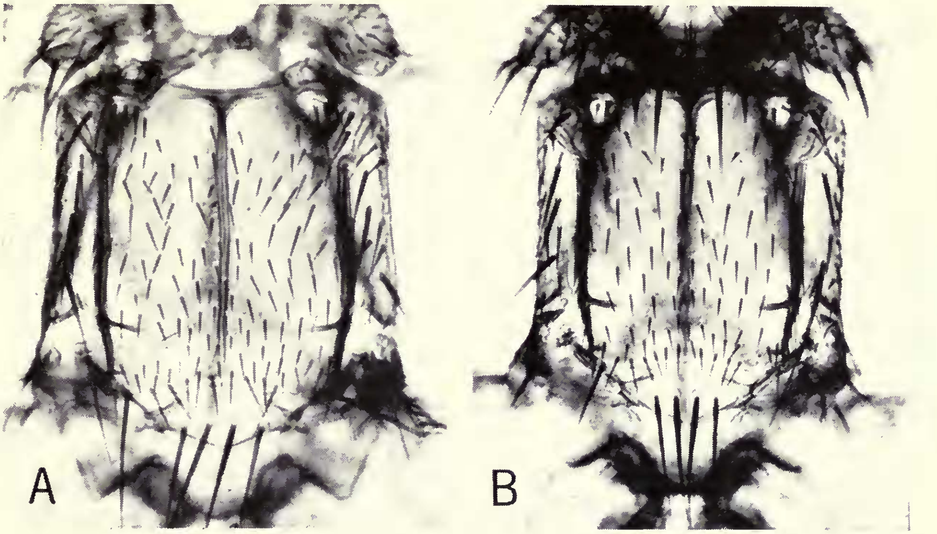

Fig. 129. Thorax, dorsal view. A, *Strebla tonatiae,* from *Tonatia brasiliensis* (CNHM no. 75586), Huajyumbe (Cuzco), PERU. B, *S. hoogstraali,* new species, same data as for fig. 126.

Strebla hoogstraali Wenzel, new species. Figures 123H, 126, 129B.

Very closely related to *S. tonatiae* (Kessel) but easily separated from that species by the distinctive mesonotal chaetotaxy, which is much sparser than it is in *tonatiae* (see fig. 129). In addition to the strikingly different chaetotaxy of the prescutum, the scutal setae of the antescutellar row are subequal in *hoogstraali,* while they are much longer at sides than at middle in *tonatiae.*

DESCRIPTION: *Head.*—Almost identical to that of *S. tonatiae.* Frontoclypeus entire, without apical detached plates. Anterior plate of laterovertices with six setae. Postocular sclerite distinct. Postgenae posteriorly with eight short bristles and, in addition one long and one medium bristle. Postvertex and occiput as illustrated (only the two inner setae are spinelets, the others are thinner than shown). Eyes consisting of a single elongate hyaline lens. Ventral ante-ctenidial area a little wider than long (21.5:18).

Thorax.—Prescutum without second pigmented suture; epaulets with four setae; disk rather sparsely setose, setae gradually sparser and a little longer anteriorly, prescutal arc of longer setae present but not conspicuous. Antescutellar setae subequal, scutum with two irregular transverse rows of setae at sides anterior to antescutellars.

Wings.—Setae of wing veins relatively longer than usual in the genus; a conspicuous macroseta at apex of costa. Length of R_s approximately equal to distance from fork to *r-m* (12:11). Sixth longitudinal bare for only a short distance at base. Third crossvein situated approximately midway between second crossvein and *r-m*. *Legs.*—Pro- and mesotibiae each with seven or eight macrosetae. Metatibiae with six macrosetae on dorsal margin; hind tarsus elongate, more than half as long as tibia, the first tarsomere slightly shorter than 2–4 combined, with a median row of six or seven long heavy plantar bristles and two on each side basally; remaining tarsomeres with very minute plantars.

Abdomen.—Anterior face of tergum I+II with one or two short setae; dorsal inner margin with two or three fine short setae; dorsal connexivum bare, except for four pairs of minute segmental setae; lateral connexival setae nearly twice as long as ventrals. *Female:* Tergum VII united with the supra-anal plate; with two pairs of macrosetae, the anterior pair longer and more widely separated than the posterior pair. Supra-anal plate with four, long, thin apical setae. Seventh sternites with about eight setae, three apical ones conspicuous macrosetae. *Male:* Sternum V with two transverse rows of discal setae at middle and laterally, sometimes with three. Setae of apical margin long, subequal, a little longer toward sides. Sternum VI large. Hypopygium as in *alvarezi*. Gonapophyses very slender, curved apically, apices knobbed; macrosetae rather short, not reaching apices of gonapophyses, inserted distal to mid-length.

Measurements:	BL	TL	WL	WW
Male	1.93–1.99	0.63–0.68	0.99–1.10	0.49–0.57
Female	2.06–2.26	0.66–0.71	1.04–1.18	0.51–0.62

TYPE MATERIAL (19 specimens [6 bats] from *Tonatia minuta*) : Holotype male and allotype female (host no. 12018) from Armila (San Blas), 29 March 1963, C. O. Handley, Jr. and F. M. Greenwell. In the collection of Chicago Natural History Museum.

Paratypes.—2, same data as the holotype; 3, same data but 7 March; 7, Las Palmitas, Guánico (Los Santos), 24 January 1962; 8 (3 bats), Sibube (Bocas del Toro), 17 to 24 January 1963, C. O. Handley, Jr. Paratypes to be deposited in the collections of Chicago Natural History Museum; the United States National Museum; the Gorgas Memorial Laboratory, Panamá; the Environmental Health Branch, USAFSC, at Corozal (Canal Zone); Faculdad de Ciencias, Universidad Central de Venezuela; and the Departamento de Zoologia, Secretaria da Agricultura, São Paulo, Brazil.

REMARKS: This species is named for Dr. Harry Hoogstraal, Chief of Medical Zoology, United States Naval Medical Research Unit No. 3, Cairo, Egypt, in recognition of his many outstanding contributions to our knowledge of ectoparasites and many other aspects of medical entomology, and in appreciation of his cooperation through the years.

Strebla galindoi Wenzel, new species. Figures 123D, 124F, 125D, 130.

Distinct from all other species in that the frontoclypeus is neither entire nor with apical detached plates but is intermediate in structure, having a median unsclerotized suture (fig. 124F). It is apparently related to *S. mirabilis* but is distinct from that species in that it has no detached frontoclypeal plates and the anterior margin of the postvertex is broadly obtuse rather than strongly projecting.

DESCRIPTION: *Head.*—Frontoclypeus without apical detached plates, but with a median unsclerotized suture anteriorly. Anterior plate of laterovertices with seven to eight setae; postocular sclerites distinct. Posterior portion of dorsal sclerite of postgenae with eight short setae, and (near posterior margin) two long conspicuous ones; lateral margin not emarginate. Postvertex and occiput as illustrated in fig. 123D (the outer seta slightly more slender than shown). Eyes multi-faceted and projecting, about eight facets visible from above. Ante-ctenidial area of underside half again as broad as long (30:20).

Thorax.—Prescutum with a second anterior pigmented suture; epaulets with five long setae. Three transverse rows of setae between transverse and second sutures. Scutum at middle with two rows of setae anterior to the antescutellars, the latter unusually long and becoming even longer laterally. *Wings.*—All veins, except sixth longitudinal, with setae basally. Apex of costa without a macroseta. R_s about half again as long as distance from fork to *r-m* (17:11). *Legs.*—Protibiae with four to five much longer setae (four stout) on outer edge, about three on inner. Mesotibiae with two oblique rows of heavy setae apically on inner face, the basal row with four setae, the apical one with two; another conspicuous macroseta along dorsal edge at middle, preceded by several long, weaker setae. Metatibiae with three macrosetae on apical two fifths, the two on dorsal margin approximately as long as first two tarsomeres combined, the third lateral in position and a little more than half as long as other two. Three rows of heavy plantar bristles on first tarsomere, minute plantars on following segments.

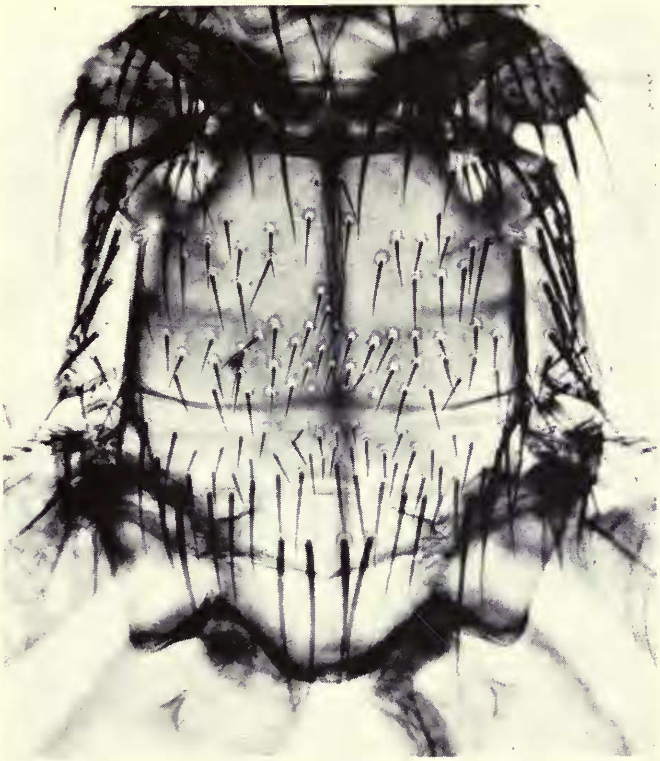

Fig. 130. Thorax, dorsal view, *Strebla galindoi*, new species, male paratype from *Tonatia bidens* (no. 5489), Almirante (Bocas del Toro).

Abdomen.—Inner dorsal margins of lateral lobes of tergum I+II with four fine setae. Connexivum with a group of three to five setae on each side of most anterior pair of segmental setae. *Female:* see *Remarks*. *Male:* Hypopygium with a dorso-lateral macroseta and medial to it a short seta; tergum IX with two pairs of macrosetae in a transverse row. Gonapophyses strongly curved and rather abruptly tapered apically; sides with numerous microsetae on a little more than apical third; ventral macroseta inserted at about basal third, not reaching apex, accessory seta well developed.

Measurements:	BL	TL	WL	WW
Male	2.47	0.82–0.93	1.65–1.76	0.82

TYPE MATERIAL: Holotype male and paratype male (slides) from *Tonatia bidens* (host no. 5489), Almirante (Bocas del Toro), 28 January 1960, C. M. Keenan and V. J. Tipton. Holotype in Chicago Natural History Museum; paratype in the United States National Museum.

OTHER MATERIAL EXAMINED: A female, from *Tonatia* sp., Coora T. P. D. Estate, Quiram Road, St. Patrick Co., TRINIDAD, 13 January 1959 [TVL].

REMARKS: The female from Trinidad is too badly damaged to permit study of the abdominal characters. It has about 12 setae on each of the seventh sternites.

This species is named in honor of Mr. Pedro Galindo of the Gorgas Memorial Laboratory, in recognition of his noteworthy contributions to our knowledge of the ectoparasites of Panama, and for his invaluable assistance in facilitating the field work in Panama.

Strebla christinae Wenzel, new species. Figures 44A, 124E, 131A.

S. christinae n. sp. is the only species of those with detached frontoclypeal plates that lacks a second or anterior pigmented mesonotal suture. From related species that have numerous strong metatibial setae and multifaceted eyes—*diphyllae* n.sp., *vespertilionis* (Fabricius), *mirabilis* (Waterhouse)—it may be recognized by the relatively short spine-like setae and shape of the postvertex (fig. 124E) and, in the female, by the conspicuous anteriorly produced lobe of the ventral arc.

DESCRIPTION: *Head.*—Detached frontoclypeal plates irregular, about as wide as long. Anterior plate of laterovertices with seven setae; postocular sclerite distinct. Dorsal surface of postgenae not emarginate laterally, its posterior portion with 10–11 shorter but conspicuous setae, one very long posterior seta and lateral to it one that is about half as long. Postvertex and occiput as illustrated. Eyes multi-faceted, projecting, about seven facets visible from above. Ventral ante-ctenidial area a little wider than long (21.5:19.5).

Thorax (fig. 131A).—Prescutum lacking a second pigmented suture; setae rather uniformly distributed and extending anteriorly nearly to anterior margin along median suture, and to epaulets along sides, the epaulets consisting of three to five setae which merge into the median prescutal setae; arc of longer setae poorly defined, only the two outer setae distinctive. Scutal setae of antescutellar row longer than discals and becoming longer toward sides; discal setae arranged in three transverse rows. *Wings.*—All veins except sixth longitudinal setose to base. A longer seta at apex of costa but not a macroseta. R_s nearly half again as long as distance from fork to *r-m*. *Legs.*—Dorsal edge of metatibiae with a double row of 10–12 macrosetae, of varying length. First segment of hind tarsi with a transverse row of three coarse plantar bristles a little beyond middle, and five or six shorter, finer ones basally; plantars of segments 2–4 distinctive but not as coarse as those of first segment.

Abdomen.—Inner dorsal margin of lateral lobes of tergum I+II with from three to five setae. *Female:* Tergum VII with a pair of macrosetae and posterior and median to them a pair of setae about one-fourth as long. Supra-anal plate with four apical macrosetae and on each side four conspicuous setae, two dorso-lateral, one lateral, and one ventral. Seventh sternites with about nine setae, three of them macrosetae. Ventral arc produced anteriorly (fig. 44A) as a conspicuous microsetose lobe; with four short setae, inner pair twice as long as outer. *Male:* Sternum V short, with no more than two transverse rows of discal setae throughout width. Sterna VI and VII+VIII forming a wide ring. Hypopygial setae as in *diaemi* n.sp. Gonapophyses curved basally, nearly straight apically, apices mucronate below; ventral macroseta inserted at about basal third, short, extending only a little more than half the distance to apex; accessory seta minute; with scattered microsetae along sides on apical third.

Measurements:	BL	TL	WL	WW
Male	2.75–2.87	0.93	1.65–1.81	0.95–0.99
Female	2.97–3.00	0.93–0.96	1.81–1.92	0.93–1.04

TYPE MATERIAL: Holotype male, allotype female (slides) and 7 paratype females from *Phylloderma stenops* (host no. 11986), Armila (San Blas), 26 March 1963, C. O. Handley, Jr. and F. M. Greenwell. 1 male paratype, same data, but 27 February 1963. Holotype and allotype in the collection of Chicago Natural History Museum. Paratypes in the collections of Chicago Natural History Museum; the United States National Museum; and the Environmental Health Branch, U. S. Army, at Corozal (Canal Zone).

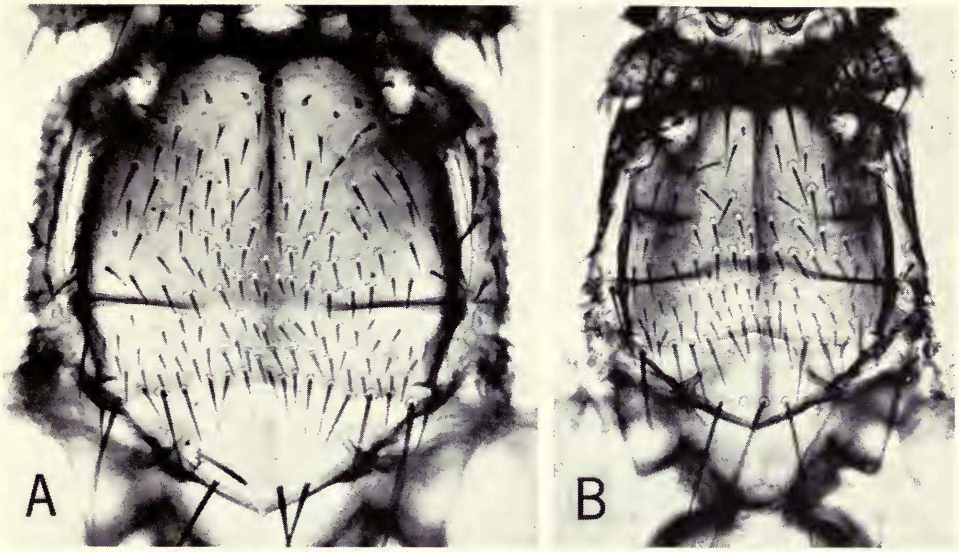

Fig. 131. Thorax, dorsal view. A, *Strebla christinae*, new species, male paratype. B, *S. machadoi*, new species, holotype.

This species is named for Christina Johnson Fowler in grateful appreciation of her invaluable assistance in producing this volume.

Strebla machadoi Wenzel, new species. Figures 124D, 131B.

S. machadoi n. sp. is easily separated from all other species in that it is the only one with detached frontoclypeal plates that has non-faceted eyes. The subacuminate anterior margin of the frontoclypeus is also distinctive.

DESCRIPTION (*Female*): *Head.*—Detached frontoclypeal plates small, about as wide as long. Anterior plate of laterovertices with six setae; postocular sclerite distinct. Dorsal sclerite of postgenae posteriorly with five or six short bristles, a long, conspicuous one on postero-median angle and lateral to this a seta of intermediate length; lateral margin emarginate for reception of ctenidium. Postvertex and occiput as illustrated (fig. 124D), but with the inner three or four setae on each side more distinct spinelets than shown. Ventral ante-ctenidial area wider than long (21:17). Eyes consisting of a single elongate hyaline lens. *Thorax.*—Prescutum with a pigmented second or anterior transverse suture; prescutum sparsely setose, a bare area along median line on anterior division, except for two long setae and a short seta on each side of line; epaulets consisting of five to six stout setae; arc of longer setae distinct; two transverse rows of setae laterally between transverse and anterior suture; antescutellar bristles very long at sides, becoming gradually and distinctly longer medially, the median bristles distinctly longer than the discal scutal setae arranged in two or three irregular transverse rows.

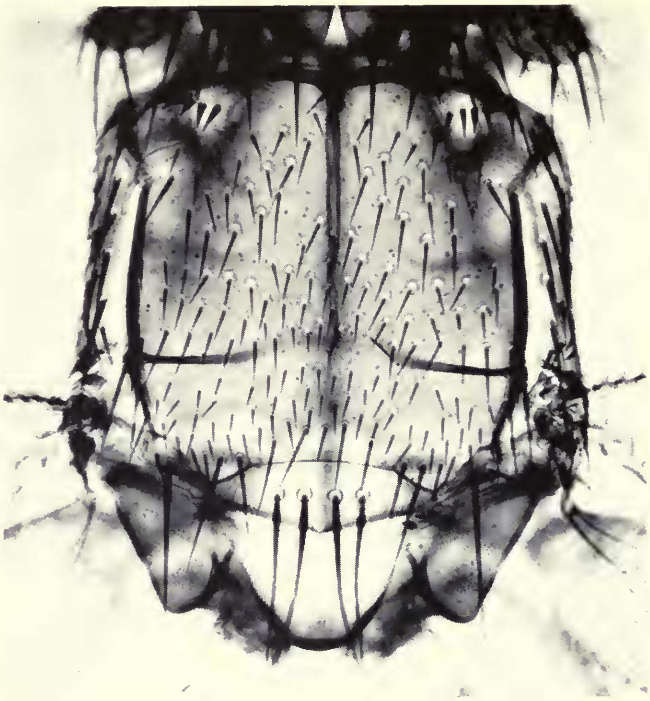

Fig. 132. Thorax, dorsal view, *Strebla vespertilionis* (Fabricius), from *Desmodus rotundus murinus* (no. 5236), Red Tank (Canal Zone).

Wings.—All veins except sixth longitudinal setose to base. Apex of costa without a macroseta. *Legs.*—Pro- and mesotibiae without distinctive characters. Metatibiae with two conspicuous macrosetae near apex, preceded by a double row of eight to ten setae that are shorter than the macrosetae but at least twice as long as the other tibial setae. First segment of hind tarsus with two rows of heavy and an inner row of weaker but still prominent plantar setae, four across apical margin; segments 3 and 4 with distinct plantar bristles, but none as heavy or as long as those of first segment, those of the fourth segment relatively weak.

Abdomen.—Anterior face of tergum I+II with four short setae; inner dorsal margin with two fine setae. *Female:* Tergum VII with a pair of macrosetae and posterior to them a pair of more closely placed, shorter setae that are less than one-half as long as macrosetae. Supra-anal plate with four long apical setae and a pair of short setae on each side near base. Seventh sternites with eight setae, two of these macrosetae. Ventral arc produced anteriorly as a broad, short, rounded microsetose lobe about twice as wide as long, with two long and two short setae on posterior edge. *Male:* Unknown.

Measurements:	BL	TL	WL	WW
Female	2.39	0.77	1.65	0.85

TYPE MATERIAL: Holotype female from *Micronycteris minuta* (host Machado-Allison no. 495), La Guanote, Caripe (Monagas), VENEZUELA, J. Ojasti. In the collection of the Faculdad de Ciencias, Universidad Central de Venezuela, Caracas. A paratype, sex undetermined (abdomen missing), same data as the holotype, in the collection of Chicago Natural History Museum.

REMARKS: This species is named for Dr. Carlos Machado-Allison, of the Departamento de Parasitología y Microbiología, Faculdad de Ciencias, Universidad Central de Venezuela, in recognition of his valuable contributions to the study of ectoparasites.

Strebla vespertilionis (Fabricius). Figures 123B, 125B, 132.

Hippobosca vespertilionis Fabricius, 1805, Syst. Antliat., p. 339.6—"America meridionalis vespertilione" (Type: See discussion below.)

Strebla vespertilionis Wiedemann, 1824, Analect. Ent., p. 19, fig. 7; 1830, Aussereurop. Zweifl. Ins., **2**: 612, pl. xb, fig. 13a, b. Macquart, 1835, Hist. Nat. Ins. Dipt., **2**: 637, pl. 24, fig. 16. Walker, 1849, List. Dipt. Spec. Brit. Mus., **4**: 1146 (cit., part.). Osten-Sacken, 1878, Cat. N. Am. Dipt., Smiths. Misc. Coll., no. 270, p. 214 (cit., part.)

Strebla wiedemannii (new name for *vespertilionis* Fabricius [not Nitsch, 1803], in error), Kolenati, 1856, Parasiten d. Chiropt., p. 46. Speiser, 1900, Arch. Naturg., **66A**, Bd. I, pp. 32, 43 (status); 1907, Ent. News, **18**: 103. Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, **5**: 31 (cit. only, not fig.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 654 (cit.).

Euctenodes mirabilis (not Waterhouse, 1879), Kessel, 1924, Parasitology, **16**: 411 (part., from *Desmodus* sp.), figs. 2, 3; 1925, Jour. N. Y. Ent. Soc., **33**: 30 (part., from *Desmodus* sp.), pl. 3, fig. 21, pl. 4, figs. 22, 23. Stiles and Nolan, 1938, Bull. Nat. Inst. Hlth., Wash., no. 155, pp. 654, 732 (part., from *Desmodus* sp.). Jobling, 1949, Parasitology, **39**: 318–19, 328 (part., from *Desmodus rotundus*), (? figs. 3 D, E.). Hoffmann, 1953, Mem. Congr. Cient. Mex., **7**: 188 (? part., from *Desmodus r. murinus*). Goodwin and Greenhall, 1961, Bull. Amer. Mus. Nat. Hist., no. 122, p. 269.

Kolenati (1856) erroneously regarded *Strebla vespertilionis* as a homonym, changed the name to *Strebla wiedemannii*, and noted:

> "Das Original exemplar sich in konigl. Museum zu Kopenhagen."

In 1863 (p. 18), however, Kolenati stated:

> "Das Original exemplar aus der zu Kopenhagen existierenden alten Toüder Liênd-Schestedt'schen Sammlung, welches Wiedemann zur Beschreibung und Abbildung überlassen wurde, ist entweder bei die Zeichung verloren gegangen, *oder nicht mehr zurückgegeben worden, weil an dem Platze dieses Originalstückes, welcher vorhalten blieb als die Sammlung vor 30 Jahren umgestellt wurde, kein nadelstich ist* [italics ours]. Diese Mitthieilung machte mir Prof. Steenstrup, am 10 Nov. 1857."

Dr. Sven G. Larson (pers. comm.) of the Copenhagen Museum recently confirmed the absence of the type of *vespertilionis* and added:

> "If there is a possibility that Wiedemann, for some reason or another, did not return the animals to the owners (Sehested & Tønder Lund), the type may possibly be in Vienna, where most of Wiedemann's animals are found, as far as I know."

We then asked Prof. Dr. Max Beier of the Vienna Museum to see if there were specimens in Wiedemann's material that could possibly be Fabricius' type. To our surprise, Dr. Beier answered:

> "... übersende ich Ihnen mit gleicher Post unser einziger Exemplar von *Strebla vespertilionis* F. Dieses Stück stammt zweifellos aus der Sammlung Wiedemann, da es die grüne Etikett am Klebeblättchen trägt. . . . Wahrscheinlich handelt es sich also um die verschollene Type von Fabricius."

The specimen is of a species that parasitizes *Desmodus rotundus.* It carries four labels: one reading "Strebla vespertilionis, Pernambuco, Bgt.;" a second, reading "Schiner 1869;" a third "vespertilionis det. Speiser" (!); and the fourth, reading "Strebla vespertilionis F." The specimen is glued to a celluloid card, which bears a green, quadrangular marker at the base. The "Bgt." on the first label is puzzling. It is possible that it is an abbreviation of Bigot. The word "Strebla" is hand-printed and resembles the sample of Bigot's hand-printing given by Horn and Kahle (Ent. Beihefte, 2, pl. 11, fig. 1). The specimen seems to have come to the Vienna Museum through the Schiner collection in 1869. This, too, is puzzling, since, according to Horn and Kahle (ibidem, 4, p. 302), the Wiedemann Diptera went to Vienna *via* W. von Winthem, and the same authorities (p. 305) state that the von Winthem Diptera went to that museum in 1852. We are not convinced that this specimen is the type of *vespertilionis,* but in view of Dr. Beier's experience, we accept it as an authentic Wiedemann specimen. If it is not the type, however, it is quite possible that it is the specimen upon which Wiedemann based his 1830 description and illustration (see p. 591). It is certainly congeneric with the specimen figured, and it matches in the setation of the hind tibiae, taking into account the poor quality of the figure. Since we cannot demonstrate that this specimen is Fabricius' type, we designate it as a neotype, so as to fix the identity of the type-species of the type-genus of the family.

As pointed out by Speiser, *Strebla wiedemannii* Kolenati, 1863, is not the same as *wiedemannii* Kolenati, 1856 (& 1857). Speiser considered it to be identical with *Trichobius parasiticus* and *T. dugesii* Townsend. Actually, it probably was a mixture of species and the specimen illustrated (Kolenati, 1863, pl. 16, fig. 36) may be an undescribed species of *Trichobius* that occurs in the West Indies, Mexico, and Guatemala.

Strebla vespertilionis of von Röder (1896, p. 26) from *Vampyrops lineatus* was probably a species of *Paratrichobius. Strebla avium* Macquart (1854, p. 308) could have been a hippoboscid. We have not seen the original description. To our knowledge, no one has re-examined the type. It was supposed to be in Macquart's collection at Marseilles. We do not know if it exists or not.

Dr. T. C. Maa has examined the type of *Strebla mexicana* Rondani (1878, p. 168). According to him (pers. comm.), it is heavily coated with dirt, but on the basis of a superficial examination, he believes it to be "a *Euctenodes*" [= *Strebla*]. Only a few species of *Strebla* are known to us from Mexico. They include *S. vespertilionis, carolliae* n. sp., *diphyllae* n.sp. and *hertigi* n. sp. We hope that in the future there will be an opportunity to clean and make a slide preparation of the type of *mexicana* so as to establish its identity. It is in the museum at the University of Florence (Italy).

S. vespertilionis is similar to *machadoi* n. sp. and *christinae* n. sp. in possessing two rows of six or seven conspicuously longer setae each, on the upper edge of the metatibiae (fig. 125B). It differs conspicuously from both in mesonotal chaetotaxy (fig. 132) and from *machadoi* in having multifaceted eyes rather than a single hyaline lens, and from *christinae* in having a second or anterior pigmented transverse suture, as well as the other characters given in the key. Actually, *vespertilionis* appears to be more closely related to *diphyllae*, but this species has only a single dorsal row of longer metatibial setae and it has distinctly curved gonapophyses. The only other species known to us that have nearly straight gonapophyses are *S. hertigi* n. sp., *consocius* n. sp., and *diaemi* n. sp. In the two last-named species, the ventral macroseta is inserted distal to middle on the gonapophysis, while in *hertigi* and *vespertilionis,* it is inserted basally. *S. hertigi,* however, belongs to the group of species with entire frontoclypeus; its eyes consist of a row of four facets; and its gonapophyses, apically, are upwardly sinuate rather than downwardly curved.

DESCRIPTION: *Head.*—Frontoclypeus with apical detached plates that are distinctly longer than broad. Anterior plate of laterovertices with eight setae; postocular sclerite distinct. Dorsal sclerite of postgenae not emarginate laterally; posterior portion with 11–13 short setae and near posterior margin, two long setae. Postvertex and occiput as figured (fig. 132B), but with most of the long occipital setae and spinelets of postvertex more slender than shown. Eyes multi-faceted. Ventral ante-ctenidial area distinctly wider than long (30:22).

Thorax (fig. 132).—Prescutum with a pigmented second or anterior transverse suture; epaulets consisting of five or six spinelets; arc of longer setae distinct; discal setae not reaching epaulets; three irregular transverse rows of setae between transverse mesonotal suture and anterior suture. Antescutellar setae much longer than other scutal setae, those near sides longer than those at middle. *Wings.*—All veins except sixth setose to base. Seta at apex of costa not a macroseta. R_s nearly twice as long (22.5:13) as distance from fork to crossvein *r-m*. *Legs.*—Protibiae dorsally with three heavy setae along inner edge, near apex, preceded by four slender, shorter setae; outer edge with one or two strong setae near apex. Mesotibiae apically with about five strong dorsal setae on outer edge; inner edge with two strong setae preceded by a row of weaker ones. Metatibiae (fig. 125B) with about 14 conspicuous setae in a double row, the apical two nearly twice as long as the others. Ventral surface of hind tarsus with a median, longitudinal row of five very heavy plantar bristles and lateral to these, basally, a row of five very short plantars along inner edge; plantar bristles of succeeding segments minute.

Abdomen.—Inner dorsal margins of lateral lobes of tergum I+II with three to four setae. *Female:* Tergum VII with variable chaetotaxy, usually with three pairs of setae, an anterior pair of macrosetae and posterior to these two pairs of shorter strong setae. Supra-anal plate with four apical macrosetae and on each side near base a pair of setae that are about one-third as long. Seventh sternites with about 17 setae, seven or eight of them very long, about five much longer than the others. Ventral arc with both anterior and posterior margins slightly indented, not produced; with four setae, two longer, two minute. *Male:* Hypopygium as in *S. diphyllae* n.sp. Gonapophyses gradually tapered, with both dorsal and ventral margins curved to the knobbed apices; sides, especially on apical third, with numerous microsetae; ventral macroseta inserted at about basal third, extending about three-fourths the distance to apex; accessory seta minute.

Measurements:	BL	TL	WL	WW
Male	2.97–3.03	0.93–1.00	1.70–1.91	0.82–0.89
Female	2.94–3.41	1.00–1.04	2.03–2.17	0.89–0.96

PANAMANIAN MATERIAL EXAMINED: 50 lots, 288 specimens, from more than 92 bats. From *Desmodus r. murinus:* 1, Paraíso (Canal Zone), 17 November 1960; 9, Red Tank (Canal Zone), 27 January 1960; 45 (7 bats), Almirante (Bocas del Toro), 23 to 31 January 1960; 1, Changuinola (Bocas del Toro), 27 February 1960; 72 (40 bats), Casa Tilley near Cerro Punta (Chiriquí), 23 January and 6 February 1960; 1, same locality, 11 March 1962; 5, Chilibrillo Caves (Panamá), 2 May 1957 [USNM]; 2, same locality, L. H. Dunn no. 878 [MCZ]; 4, San Pedro Cave, Taboga Island (Panamá), L. H. Dunn [MCZ]; 12, near La Chorrera (Panamá), 18 April 1959, H. Trapido; 112 (10 lots, 12 bats), Guánico (Los Santos), 26 January to 25 February 1962; 22 (3 bats), Río Tuira (Darién), 24 to 27 February 1958, P. Galindo [GML]; 3, Río Mono Camp (Darién), 24 July 1963, W. Lowe [GML]. From *Artibeus jamaicensis:* 3 (9 bats), Almirante (Bocas del Toro), 26 and 28 January 1960. From *Vampyrodes major:* 2, Almirante (Bocas del Toro), 22 January 1960. From *Lasiurus egregius:* 1, Armila (San Blas), 23 February 1963.

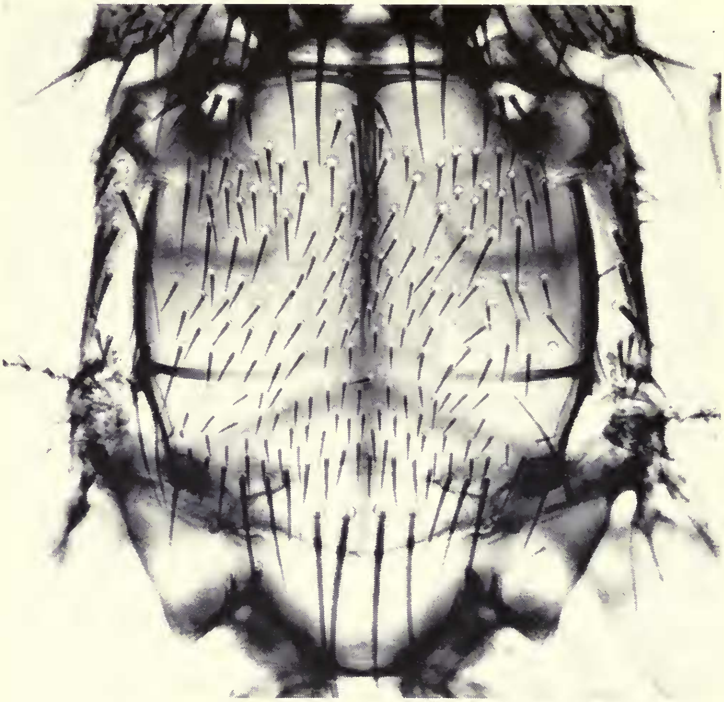

Fig. 133. Thorax, dorsal view, *Strebla diphyllae,* new species, male paratype, same data as holotype.

OTHER MATERIAL EXAMINED: 1162 flies in 113 lots, from more than 150 bats, mostly from *Desmodus rotundus,* from 69 localities in MEXICO, GUATEMALA, HONDURAS, EL SALVADOR, COLOMBIA, ECUADOR, PERU, VENEZUELA, TRINIDAD, and SURINAM.

REMARKS: 96% of all the lots and 97% of all the specimens of *S. vespertilionis* examined were from *Desmodus rotundus.* Excluding one collection from mixed hosts that included *Desmodus*, only 7 lots (including those from Panama) are from bats other than *Desmodus*. These bats include *Lasiurus egregius* (a genus not known to harbor Streblidae), *Artibeus jamaicensis, Vampyrodes major, Saccopteryx bilineata, Centurio senex, Carollia perspicillata* and *Phyllostomus discolor*. From the history and nature of the collections, we are convinced that some of these represent contaminations or errors of association. However, several obviously represent temporary or transitory associations.

Kessel (1924, p. 411) stated that her redescription of *E. "mirabilis"* was based on a specimen from *Hemiderma* [= *Carollia*] *perspicillatum*, but her figures are obviously of *Strebla vespertilionis*, which occurs on *Desmodus rotundus*. Jobling has informed us (pers. comm.) that his figures (1949, figs. 3D, E) of *"mirabilis"* were based on a specimen from *Desmodus r. rotundus* from Diego Martin Cave, Trinidad. One would assume, then, that this specimen was *vespertilionis*. However, the short, detached frontoclypeal plates are much more like those of *mirabilis* than those of *vespertilionis*, and it will be necessary to examine his slide to determine the identity of his specimen.

Strebla diphyllae Wenzel, new species. Figures 124C, 133.

Euctenodes mirabilis (not Waterhouse, 1879), Bequaert, 1933, Publ. Carnegie Inst. Wash., no. 431, p. 571. ?Hoffmann, 1953, Mem. Congr. Cient. Mex., 7: 184, 188 (part., from *Diphylla*).

Very closely related to *S. vespertilionis* (Fab.), but differing from it in having shorter frontoclypeal plates; more densely setose prescutum; tergum VII of female with four rather than six setae; and male gonapophyses distinctly bent rather than nearly straight.

DESCRIPTION: *Head.*—Short. Frontoclypeus with apical detached plates, these slightly wider than long. Anterior plate of laterovertices with eight setae; postocular sclerite distinct. Postgenae with lateral margins not marginate, posteriorly with eight or nine short bristles and near margin two long conspicuous bristles, the inner one nearly as long as the setae of postvertex, the outer one a little shorter; lateral to them a shorter bristle. Postvertex and occiput as illustrated (fig. 124C). Eyes multi-faceted with seven or eight facets visible from above. Ventral ante-ctenidial area wider than long (32.5:21).

Thorax.—Prescutum with anterior transverse suture; epaulets consisting of five to six stout spinelets; setose area of disk extending anteriorly along mid-line to the double pair of short setae behind the anterior margin, and along sides nearly to epaulets; arc of seven longer setae distinct; three rows of setae laterally between transverse and anterior sutures. Scutum with about three transverse irregular rows of setae; antescutellar setae long. *Wings.*—All veins except sixth with setae to base; costa without an apical macroseta. R_s about half again as long (30:21) as distance from fork to *r-m*. *Legs.*—Protibiae with about three heavy conspicuous setae, preceded by several long fine setae on inner margin; outer margin with two or three heavier setae. Mesotibiae with eight or nine conspicuously coarser setae. Metatibiae with a dorsal row of nine or ten long setae, the apical one about as long as first segment of hind tarsus, the others progressively shorter anteriorly, the basal ones about twice as long as short setae on lateral face. Ventral surface of first segment of hind tarsus with three longitudinal rows of heavily pigmented conspicuous plantar bristles, those along inner edge smaller; plantar bristles of following segments very small but stout.

Abdomen.—Inner dorsal margins of tergum I+II with about four setae. *Female:* Tergum VII with two long macrosetae and a pair of shorter setae, posterior and medial to them, only a little more than half as long. Supra-anal plate with a median pair of strong setae along basal margin in addition to the four apical macrosetae. Seventh sternites with 20–21 setae. Ventral arc slightly thickened at middle, with two longer and two minute setae. *Male:* Hypopygium dorsally with a lateral macroseta and medial to it a very short seta on sternum VII+VIII, and on tergum IX a transverse row of six macrosetae, the medial pair longest. Gonapophyses strongly bent a little beyond middle; macrosetae inserted near middle, not reaching knobbed apices; sides with scattered microsetae on a little more than apical third.

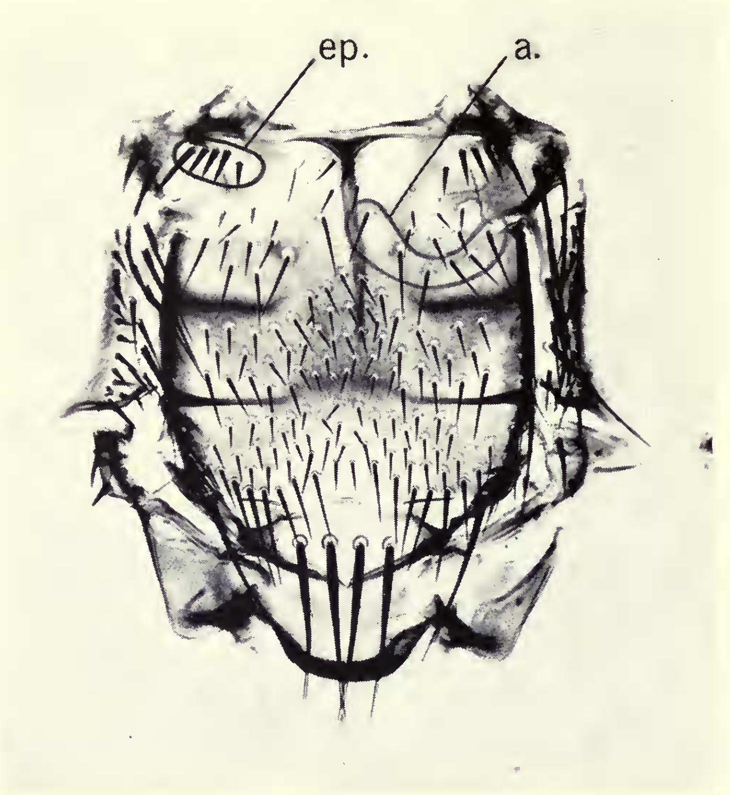

Fig. 134. Thorax, dorsal view, *Strebla mirabilis* (Waterhouse), male from *Phyllostomus h. panamensis* (no. 4138), Natural Bridge, Madden Dam (Canal Zone). *ep* = epaulet; *a* = prescutal arc of setae.

Measurements:	BL	TL	WL	WW
Male	2.11–3.20	1.02–1.04	1.81–1.92	0.91–0.93
Female	3.20–3.53	1.00–1.07	1.84–2.47	1.10–1.21

TYPE MATERIAL: GUATEMALA (CNHM Guatemala Zoological Expeditions, 1936, 1948, 1951–52).—Holotype male and allotype female (slides) from *Diphylla ecaudata centralis* (CNHM cat. nos. 73191–94, 73345–46), San Lorenzo, 4 miles northeast of Volcan de Jumay (Jalapa), 5700–5750 feet elevation, 15 February 1952, R. D. Mitchell and Luis de la Torre. In the collection of Chicago Natural History Museum.

Paratypes.—From *Diphylla e. centralis:* 13 (7 bats), same data as the holotype; 3 (5 bats), Finca El Progresso (Santa Rosa), 4500 feet elevation, 3 August 1951, Luis de la Torre; 4, Finca Recreo, Municipio Yepocapa (Chimaltenango), elevation 4400 feet, 11 May 1948, R. L. Wenzel, L. de la Torre, and R. D. Mitchell; 15 (5 bats), same locality, 25 October 1948, R. D. Mitchell and L. de la Torre. From *Trachops cirrhosus coffini:* 1, Finca Recreo (Chimaltenango), 2 May 1948, Wenzel, Mitchell and de la Torre. From *Desmodus rotundus murinus:* 5 (5 bats), Finca El Progreso (Santa Rosa), 3 August 1951, L. de la Torre; 2, Finca Olas de Moca (Sololá), 2700 feet elevation, 3 March 1934, F. J. W. Schmidt.

Non-Guatemalan Paratypes. MEXICO.—From *Diphylla e. centralis:* 2, Yocat (Yucatan), R. T. Hatt [MCZ, det. Bequaert, 1933, as *E. mirabilis*]; 18, Xilitla (San Luis Potosi), C. R. Shaw [MCZ]; 4, 2 km. north of Felipe Carillo Puerto (Quintana Roo), 16 August 1962, J. Knox Jones [KU]. Paratypes to be deposited in the collections of Chicago Natural History Museum; the United States National Museum; Snow Entomological Museum, the University of Kansas; the Museum of Comparative Zoology at Harvard University; and the Environmental Health Branch, USAFSC at Corozal (Canal Zone).

REMARKS: The Guatemalan records from *Trachops* (Finca Recreo) and *Desmodus* (Finca El Progresso) almost certainly represent strays from other bats collected at the same time and placed in the same bags as specimens of *Diphylla e. centralis.* This does not seem to be true for the specimens from *Desmodus* collected at Finca Olas de Moca. Six specimens of *S. vespertilionis* n. sp. were collected together with three *S. diphyllae,* from the same host specimen. As nearly as can be determined from the field records, no specimens of *Diphylla ecaudata* were collected at that locality.

Although *Diphylla ecaudata* was collected in Panama, no specimens of *Strebla diphyllae* were obtained. In Venezuela, a new species (not described here) related to *mirabilis,* was collected from this host by C. O. Handley, Jr. In view of the fact that monotypic New World hosts do not, in any instance known to us, have different streblids in different parts of their range, the suggestion of Burt and Stirton (1961, p. 37) that *Diphylla ecaudata* is monotypic should be questioned.

Strebla mirabilis (Waterhouse), *new combination.* Figures 123A, 125E, 134, 135A.

Euctenodes mirabilis Waterhouse, 1879, Trans. Roy. Ent. Soc. Lond., 1879: 310, pl. 10, figs. 1, 2. Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Veter., Nictheroy, 5: 32 (cit.). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Ex., Fis. y Nat., 3: 418 (part., from *Phyllostomus h. panamensis*). Cooper, 1941 (part.), Yearb. Amer. Phil. Soc., 1941: 126 (chromosome no.).

Closely related to *S. kohlsi* but distinct in having a shorter head and shorter frontoclypeal plates (see key). It is primarily a parasite of *Phyllostomus hastatus,* though it may also occur on *Trachops* (see below). *S. kohlsi* is known to us from *Tonatia silvicola. Phyllostomus, Trachops,* and *Tonatia* are related genera of the subfamily Phyllostominae.

DESCRIPTION: *Head.*—Frontoclypeus with apical detached plates, these approximately as long as wide, though inner margin is appreciably longer than apical. Anterior division of laterovertices with eight setae; postocular sclerite distinct. Dorsal sclerite of postgenae not emarginate laterally, its posterior portion with ten fine and mostly very short setae and, along posterior margin, two conspicuous long setae. Postvertex and occiput as illustrated (fig. 123A). Eyes convex, multi-faceted, about eight facets visible from above. Ventral ante-ctenidial area wider than long (59:41).

Thorax (fig. 134).—Prescutum with second anterior pigmented suture; epaulets with four to five setae; discal setose area not extending to epaulets; arc of long setae very distinct. Scutal setae of antescutellar row longer toward sides; three transverse rows of setae present between them and the transverse mesonotal suture. *Wings.*—R_s less than twice as long (22:13) as distance from fork to crossvein *r-m*. Seta at apex of costa longer than others preceding it but not a conspicuous macroseta. Fifth longitudinal vein bare for a short distance before base. *Legs.*—Protibiae with a double row of longer setae along dorsal edge, the basal ones small, the apical three on inner edge and two on outer edge very stout; apices with two strong curved ventral setae. Setae of mesotibiae very similar to those of protibiae. Metatibiae with two conspicuous macrosetae on apical third, these preceded by a distinctly shorter and finer seta and then a row of five or six shorter setae, all of them longer than the other tibial setae. Ventral surface of first segment of hind tarsi with two rows of heavy, short plantar bristles along outer half and an irregular row or two of shorter bristles along inner edge; following segments with minute, very fine plantar bristles that can hardly be detected except in slide preparations.

Abdomen.—Inner dorsal margins of lateral lobes of tergum I+II with four to six setae on each side. Sternum II with setose median triangular area, the apical marginal setae conspicuously longer than the discals, a conspicuously long macroseta on each side of middle, separated by about four shorter setae. Dorsal connexival setae along sides longer than ventral setae, those along lateral margins shortest. *Female:* Tergum VII roughly tear-drop shaped; distally with a pair of very long macrosetae and medial and posterior to these, a pair of setae that are only half as long. Supra-anal plate with four apical macrosetae and a pair of shorter discal setae. Seventh sternites with 11–12 setae, two to four of them very long macrosetae. Ventral arc with two long and two minute setae; produced anteriorly as a small poorly sclerotized lobe. *Male:* Sternum V well developed; apical margin with about eight conspicuous macrosetae alternating with shorter setae, all longer than discals, of which there are two transverse rows at middle and three toward sides. Hypopygium with a very long macrosetae on each side and medial to this a short bristle on sternum VII+VIII; dorsum of tergum IX with three pairs of macrosetae. Gonapophyses bent apically, with scattered microsetae along middle on apical half; apices knobbed; ventral macroseta not reaching apex.

Measurements:	BL	TL	WL	WW
Male	2.32–2.72	0.86–0.93	1.54–1.65	0.81–0.84
Female	2.58–3.08	0.92–0.97	1.73–1.94	0.91–0.95

PANAMANIAN MATERIAL EXAMINED.—From *Phyllostomus hastatus panamensis:* 140 (17 bats), hollow tree, Chepo Road (Panamá), 8 October 1959; 112 (20 bats), Chilibrillo Caves, 17 July 1959; 4 (2 bats), same locality, 18 August 1959; 322 (13 bats), 28 October 1959; 3, same locality, 2 May 1957 [USNM]; 11, same locality, K. W. Cooper [MCZ]; 2, same locality from preserved museum specimens collected 4 September 1934 by L. D. Lamm; 147, same locality, L. H. Dunn, no. 436 [MCZ]; 1, Tapia (Panamá), 25 July 1923, J. P. Chapin [MCZ]; 1, "Panama" [MCZ]; 12, Farfan (Canal Zone), 19 December, T. Hallinan [AMNH]; 168 (20 bats), Natural Bridge, Madden Dam (Canal Zone), 31 August, 28 September 1959; 77 (5 bats), hollow *Ficus* tree, Fort Kobbe (Canal Zone), 9 October 1959; 4 (3 bats), Fort Sherman (Canal Zone), 30 July 1959; 149 (19 bats), 4 and 6 April 1960; 14, France

Air Force Base (Canal Zone), 8 October 1959; 7, hollow tree, 1 mile from Gatuncillo (Canal Zone), 28 July 1960; 3, Almirante (Bocas del Toro), 29 January 1960. From *Phyllostomus* sp.: 11, Camp Piña (Canal Zone), 26 October 1960. From *Carollia p. azteca:* 25 (3 bats), Natural Bridge, Madden Dam (Canal Zone), 31 August 1959. *Without host:* 1, Chilibrillo Caves (Panamá), 27 August 1959; 30, same locality [MCZ]; 2, same locality, 1 January 1916, T. Hallinan [AMNH]; 31, Barro Colorado Island (Canal Zone), 2 December 1956, K-18 [USNM].

OTHER MATERIAL EXAMINED: MEXICO.—*Without host:* 1, "either from Campeche, Mexico or Yucatan. Original vial had label no. 15 plus included." COLOMBIA.—From *Phyllostomus hastatus:* 6 (3 bats), "Las Campañas," Coloso (Bolivar), 23 May 1949, P. Hershkovitz, CNHM Colombian Zoological Expedition (1949–51); 1, Pitalito (Huila), 1350 meters elevation, 29 November 1951. From *Tonatia* sp.: 1, Río Guayapa, La Macarena (Meta), 10 April 1957, Kjell von Sneidern, CNHM Colombian Zoological Expedition, 1957. PERU.—From *Phyllostomus hastatus:* 2, Vitoc Valley, Province Parma (Junín), 18 September 1940, F. Woytkowski. From *Phyllostomus* sp.: 1, Santa Rita, Iquitos (Loreto), 4 September 1956, C. Kalinowski, CNHM Peru Zoological Expedition, 1956. BOLIVIA.—From "Fledermaus," 2, Mina Cristalmaya (Cochabamba), October 1949, Luis Peña.

REMARKS: Both Mr. B. Jobling and Prof. Oskar Theodor have kindly examined the type of *mirabilis* and compared it with specimens of several related species which we sent them. In addition, Prof. Theodor referred to our manuscript keys and figures. He supplied us with notes and sketches which leave no doubt as to the identity of *mirabilis*. Probably most records that have been published for *mirabilis* from *Phyllostomus hastatus* are of this species. However, one cannot be certain without examining the specimens, since at least two other species also occur on this host. In addition to the verified records given above, *mirabilis* has been reported from *P. hastatus* by Kessel (1924, 1925), Stiles and Nolan (1931), Pessôa and Guimarães (1940), Schuurmans-Stekhoven Jr. (1941), Jobling (1949b), and Goodwin and Greenhall (1961).

We have additional specimens from hosts such as *Tonatia bidens* in Brazil (Urucum de Curumba) and *Vampyrops vittatus* (same locality and expedition), but we are not certain of their identity. We have recently segregated specimens of a very closely related species, taken from *Diphylla ecaudata* in Venezuela, which we were unable to describe and illustrate in time to include in this paper.

Strebla (?) mirabilis from *Trachops cirrhosus*. Figure 135B.

We have specimens that appear to be *mirabilis*, taken from *Trachops c. cirrhosus* in Panama and from *T. c. coffini* in Guatemala. The gonapophyses of these appear to be slightly more angulately bent (fig. 135B) than in *mirabilis* (fig. 135A) from *Phyllostomus*. The number of setae on the seventh sternites (each) ranged from 13–16 in specimens from *P. h. panamensis* and 11–13 in specimens from *T. c. coffini*.

It should be noted that to the north in Costa Rica and Nicaragua, *Phyllostomus h. panamensis* does not appear to carry *Strebla mirabilis*, but only *S. hertigi* (see "Host-parasite Relationships"). One explanation for the absence of *mirabilis* there, is that its range, like that of many ectoparasites, may not be as great as that of the host. However, it does appear to occur on *Trachops* much farther north, in Guatemala. Further, all of the Panamanian specimens of *mirabilis* from *Phyllostomus* were taken below ±500 feet elevation, though *P. h. panamensis* was taken at elevations of up to 2000 feet. The specimens from *Trachops c. cirrhosus* in Panama were taken from between sea level and 1700–3200 feet, while those from *T. c. coffini* in Guatemala were taken at 4400 feet. Its altitudinal distribution plus the fact that *mirabilis* is absent from the usual host in Costa Rica and Nicaragua, and yet is present on *Trachops* to the north in Guatemala suggest that the population on *Trachops* is a separate, cryptic species.

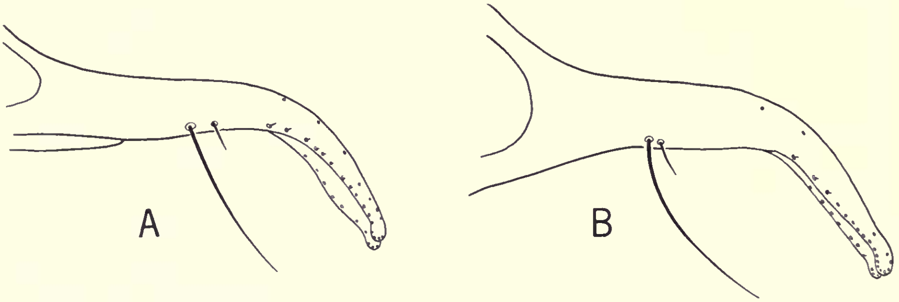

Fig. 135. *Strebla mirabilis* (Waterhouse), left male gonapophysis. A, of specimen from *Phyllostomus h. panamensis* (no. 4138), Natural Bridge, Madden Dam (Canal Zone). B, of specimen from *Trachops cirrhosus coffini* (CNHM nos. 65181–90), Finca Recreo, Municipio Yepocapa (Chimaltenango), GUATEMALA.

MATERIAL EXAMINED: PANAMA.—From *Trachops c. cirrhosus:* 2 (2 bats), Fort Sherman, 22 October and 23 November 1959; 9 (5 bats), culvert, Chepo Road (Panamá), 12 October 1959 and 24 May 1960; 29 (24 bats), Cerro Hoya (Los Santos), 1700–3200 feet elevation, 10 to 25 February 1962; 1, Armila (San Blas), 16 March 1963, C. O. Handley, Jr. and F. M. Greenwell. GUATEMALA.—From *Trachops cirrhosus coffini:* 30 (5 bats), Finca Recreo, Municipio Yepocapa (Chimaltenango), 4400 feet elevation, 11 May 1948, R. L. Wenzel, R. D. Mitchell, and L. de la Torre, CNHM Zoological Expedition (1948).

Strebla kohlsi Wenzel, new species. Figure 123C.

Related to *mirabilis* (Waterhouse) and distinguished from it by the elongated head, with ventral ante-ctenidial area hardly wider than long (24:22 as opposed to 59:41 in *mirabilis*), its slightly smaller size, and more elongated frontoclypeal plates.

DESCRIPTION: *Head.*—Elongated. Detached frontoclypeal plates present, their inner edge longer than apical margin, though basal margin is almost as wide as inner edge is long. Anterior plate of laterovertices with six setae; postocular sclerite distinct. Dorsal surface of postgenae not emarginate laterally; posteriorly with about six short setae and a long conspicuous seta and a shorter one near posterior margin. Postvertex and occiput as illustrated, but outer two setae somewhat finer than shown. Eyes multifaceted and projecting, about seven or eight facets visible from above. Ante-ctenidial area of underside only slightly wider than long (24:22).

Thorax.—Second pigmented suture of prescutum present but not very distinct; epaulets consisting of four setae; discal setose area not extending anteriorly beyond anterior end of longitudinal membranous fissures; arcuate row of long setae well defined; three transverse rows of setae laterally between sutures. Antescutellar setae more or less uniform in length. *Wings.*—Seta at apex of costa distinctly longer than those preceding it, but not a conspicuous macroseta. R_s half again as long (23:15) as distance between fork and crossvein *r-m*. Fifth longitudinal vein with a short, bare area at base, this less than half as long as bare area on sixth vein. *Legs.*—Protibiae dorsally with four heavy macrosetae on inner edge, and two or three on outer; mesotibiae with one or two on inner edge and four or five on outer, preceded by more slender long bristles. Metatibiae with two conspicuous macrosetae on apical third. Ventral surface of first segment of hind tarsi with two longitudinal rows of shorter plantar bristles near inner edge and outwardly at base a longer more conspicuous one, and across apex three additional coarser ones; succeeding segments with distinct plantar bristles but without very coarse longer ones.

Abdomen.—Anterior face of tergum I+II with two short setae; inner dorsal margin with about four fine setae on each side. *Female:* Tergum VII with a pair of macrosetae and posterior to these a pair of shorter ones that are less than half as long as anterior pair. Supra-anal plate with four apical macrosetae and, basally, a pair of shorter setae that are slightly shorter than the posterior pair on tergum VII. Seventh sternites each with about 14 setae, one a macroseta. Ventral arc slightly longer at middle, not produced as a lobe, with four setae. *Male:* Hypopygium with a dorso-lateral macroseta on each side; tergum IX with two pairs of macrosetae dorsally and another macroseta on each side.

Measurements:	BL	TL	WL	WW
Male	2.20–2.47	0.88–0.93	1.59–1.81	0.77–0.82
Female	2.28–2.58	0.80	1.59–1.76	0.74–0.77

TYPE MATERIAL: PANAMA.—Holotype male and allotype female (slides), from *Tonatia silvicola* (hosts no. 11352, 11547, resp.), Armila (San Blas), 1 and 12 March 1963, C. O. Handley, Jr. and F. M. Greenwell. In the collection of Chicago Natural History Museum.

Paratypes.—1, same data as holotype and 4, same data but 28 March 1963; 5, same host, Cerro Malí (Darién), 8 February 1964, C. O. Handley, Jr. COLOMBIA, from *Tonatia silvicola* (=*amblyotis*): 1, Puri, Cauca Valley above Caceres, 23 August 1952, P. Hershkovitz, CNHM Zoological Expedition.

REMARKS: This species is named in honor of Glen M. Kohls of the Rocky Mountain Laboratory in recognition of his outstanding contributions to our knowledge of ectoparasites, especially the systematics and biology of ticks.

Strebla carolliae Wenzel, new species. Figures 122A, 136.

Euctenodes mirabilis (not Waterhouse, 1879), Kessel, 1924, Parasitology, 16: 409 (descr.), 411 (part., from *Hemiderma* [=*Carollia*] *perspicillatum;* 1925, Jour. N. Y. Ent. Soc., 33: 30 (part., from *Hemiderma perspicillatum* and *Carollia p. azteca*). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, pp. 654, 738 (part.). Pessôa and Guimarães, 1940, Arq. Inst. Biol. São Paulo, 11: 426 (part., gives records of Kessel, 1925). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Ex., Fis. y Nat., 3: 418 (part., from *Carollia p. azteca*). Cooper, 1941 (part.), Yearb. Amer. Phil. Soc., 1941: 126 (chromosome no.). Jobling, 1949, Parasitology, 39: 318–19, 328 (part., from *Carollia perspicillata*). Goodwin and Greenhall, 1961, Bull. Amer. Mus. Nat. Hist., no. 122, p. 250.

S. carolliae may be separated from all other species of the genus by the broadly blunt anterior margin of the postvertex. It is most closely related to *alvarezi,* a smaller species with a more narrowly rounded projection of the postvertex.

DESCRIPTION: *Head.*—As illustrated (fig. 122A). Detached frontoclypeal plates wider than long. Postocular sclerite distinct. Anterior margin of postvertex very bluntly rounded. Lateral margins of postgena (above) not emarginate. Ante-ctenidial area of underside wider than long (25:17).

Thorax (fig. 136).—Second or anterior pigmented suture of prescutum present, not well defined; epaulets with five setae; lateral discal setae extending to epaulets; arc of longer setae very distinct; three rows of setae at sides, between sutures. Antescutellar scutal setae subequal, except for long, outer macroseta on each side. *Wings.*—Fifth longitudinal vein basally with conspicuous bare area near base, this less than half as long as that of sixth vein. Costa without apical macroseta. R_s nearly twice as long (19.5:10) as distance from fork to crossvein *r-m.* *Legs.*—Fore- and midlegs very similar to those of *altmani,* metatibiae with two macrosetae, one subapical, the other at about apical fourth, preceded by a row of five or six setae that are about half as long as the macrosetae and twice as long as the other tibial setae. Ventral surface of first segment of hind tarsus with long heavy plantar bristles along outer edge, and shorter weaker ones along inner edge, these of about the same size as those on following segments.

Abdomen.—Anterior face of tergum I+II with one short seta; inner dorsal margins of lateral lobes with four to five fine setae. Dorso-lateral setae of connexivum conspicuously larger than ventrals. *Female:* Tergum VII with a pair of macrosetae and posterior to them, two or three setae that are less than half as long. Supra-anal plate with four apical setae only. Seventh sternites with 12–15 setae each. Ventral arc produced anteriorly at middle as a narrowly triangular or spiniform process. *Male:* Sternum V with two transverse rows of discal setae at middle and three at sides in addition to apical marginal setae. Sternum VII+VIII (of hypopygium) on each side with a dorso-lateral macroseta and medial to it a short seta; tergum IX with a lateral macroseta on each side. Gonapophyses slender, angulately bent, apically knobbed, sides with scattered lateral microsetae apically; ventral macroseta inserted slightly posterior to basal third, extending almost to apex.

Measurements:	BL	TL	WL	WW
Male	1.99–2.31	0.74–0.81	1.42–1.46	0.71–0.75
Female	2.40–2.58	0.82–0.85	1.54–1.65	0.75–0.84

TYPE MATERIAL: Holotype male (host no. 4616) and allotype female (host no. 4618), on slides, from *Carollia perspicillata azteca,* air-raid shelter, Fort Davis (Canal Zone), 6 October 1959, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum. Paratypes include only those specimens, listed below, that were collected from species of *Carollia* in Panama and in the countries to the north.

Paratypes. PANAMA.—From *Carollia p. azteca,* 296 flies, from more than 287 bats, as follows: 15 (12 bats), same data as the holotype and 6 (7 bats), same locality, 17 November 1960, and 18 and 19 November 1959; 2, Camp Piña (Canal Zone), 26 October 1960; 8 (4 bats), Coco Solo (Canal Zone), 13 January 1960; 1, Fort Clayton (Canal Zone), 9 January 1953, F. Blanton; 2, same locality, 8 December 1960; 5 (21 bats), Fort Gulick (Canal Zone), 15 September and 29 October 1959; 1, Old Battery, Fort Randolph (Canal Zone), 1 October 1959; 10 (32 bats), Fort Sherman (Canal Zone), 23 November and 4 December 1959; 3 (2 bats), same locality, 16 March and 18 October 1960; 32 (66 bats), France Air Force Base (Canal Zone), 8 October to 30 November 1959; 11 (1 bat), Juan Mina (Canal Zone), 28 July 1960; 16 (23 bats), mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 9 September and 25 November 1959; 3 (3 bats), Brazoa Brook, Navy Tank Farm, 6 October 1959; 2 (2 bats), Rousseau Road, culvert, 13 October 1959; 18 (21 bats), railroad culvert, east of Summit Gold Club (Canal Zone), 26 October 1959; 9, "second culvert W. of bridge 5742 on the old RR" (Canal Zone), L. H. Dunn [MCZ]; 4, "RR tower culvert at tower 34–12, Summit" (Canal Zone), L. H. Dunn [MCZ]; 1, culvert, Gatun Tank Farm (Canal Zone), 19 November 1959; 9, Gatun Dam (Canal Zone), L. H. Dunn 185 [MCZ]; 3, Camp Chágres, Madden Dam (Canal Zone), 21 and 25 June 1963, GML; 2, Summit (Canal Zone) [USNM]; 7, same locality [CU]; 2, same locality, K. W. Cooper [MCZ]; 8, RR culvert, same locality, L. H. Dunn [MCZ]; 5 (2 lots), same locality, 17 April 1957, C. B. Koford [USNM]; 3, Gamboa (Canal Zone), 1 May 1957; 11, hollow tree, one mile from Gatuncillo (Canal Zone), 28 July 1960; 1, Taboga Island (Panamá), L. H. Dunn 449-A [MCZ]; 13 (10 bats), La Chorrera (Panamá), 18 September 1959; 1, culvert, Chepo Road, 12 October 1959; 3, Chilibrillo Caves (Panamá), 28 October 1959; 7 (29 bats), 18 August 1959; 37 (32 bats), Buena Vista Cave (Colón), 3 and 15 September 1959, and 24 November 1959; 4, Porto Bello (Colón), 7 August 1923 [USNM det. as *E. mirabilis* by Kessel; see Kessel, 1924]; 4, Penonomé (Coclé), L. H. Dunn 704-A [MCZ]; 1, Tacarcuna (Darién), 2 September 1958, P. Galindo [GML]; 4 (2 bats), Río Tuira (Darién), 26 February and 5 March 1958, P. Galindo [GML]; 1, Río Chucanaque, 19 February 1958, P.

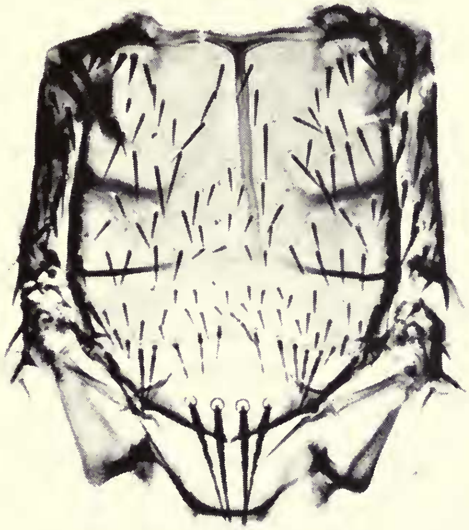

Fig. 136. Thorax, dorsal view, *Strebla carolliae*, new species, male paratype from *Carollia p. azteca* (no. 3984), Río Chilibrillo (Panamá).

Galindo [GML]; 3 (3 bats), Punta Piña (Darién), 23 and 24 March 1960; 2 (2 bats), Guánico (Los Santos), 27 January 1962; 3 (3 bats), Cerro Hoya (Los Santos), 18, 23, and 25 February 1962; 13 (11 bats), Almirante (Bocas del Toro), 26 January to 4 February 1960. From *Carollia castanea:* 2 (2 bats), Sibube (Bocas del Toro), 19 and 23 January 1963, C. O. Handley, Jr.; 2 (2 bats), Armila (San Blas), 17 February and 17 March 1963, C. O. Handley, Jr. and F. M. Greenwell; 1, La Laguna (Darién), 2900 feet elevation, 9 June 1963, GML; 1, Tacarcuna (Darién), 2000 feet elevation, 19 July 1963, GML. From *Carollia subrufa:* 1 (2 bats), Isla Bastimentos (Bocas del Toro), 3 February 1963, C. O. Handley, Jr. and F. M. Greenwell. From *Carollia* sp.: 1, Cerro Tigre (Canal Zone), 15 January 1953. From *Glossophaga soricina leachii:* 1, Bella Vista, L. H. Dunn, 397-B [MCZ]. From *Desmodus r. murinus:* 1, Chilibrillo Caves (Panamá), L. H. Dunn [MCZ]; 2, Almirante (Bocas del Toro), 29 January 1960; 1, Fort Clayton, 13 October 1959. From *Lonchorhina aurita:* 1, two miles north of Summit, 17 April 1957 [USNM]; 1, culvert E of Summit Golf Club (Canal Zone), 26 October 1959; 1, mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 25 November 1959. From *Trachops cirrhosus:* 1, Río Mandinga (San Blas), 30 May 1957. From *Macrophyllum macrophyllum:* 4 (3 bats), Fort Gulick (Canal Zone), 15 September 1959. From *Phyllostomus h. panamensis:* 1, Guánico (Los Santos), 26 January 1962; 1, hollow tree, Chepo Road (Panamá), 8 October 1959. From *Pteronotus parnellii fuscus:* 3 (3 bats), culvert east of Summit Golf Club (Canal Zone), 26 October 1959. From *Natalus mexicanus:* 1, Penonomé (Coclé), L. H. Dunn [MCZ]; From *Artibeus j. jamaicensis:* 1, Almirante (Bocas del Toro), 23 January 1960. From *Lonchophylla robusta:* 1 (16 bats), Buena Vista Cave (Colón), 16 June 1960; 1, Chilibrillo Caves (Panamá), 2 August 1960. From *"Leaf nosed bat":* 8, Chilibrillo Caves, 10 July 1945, [USNM]. *Without host:* 1, Barro Colorado Island (Canal Zone), 2 December 1956, K-19 [USNM]; 1, Farfan Cave (Canal Zone), L. H. Dunn 329-A [MCZ].

Non-Panamanian paratypes. GUATEMALA.—From *Carollia p. azteca:* 3 (3 bats), small cave, 0.2 mile northeast of Cueva de Lanquin, Lanquin (Alta Vera Paz), 10 June 1948, R. D. Mitchell and Luis de la Torre, CNHM Guatemala Zoological Expedition, 1948. From *Glossophaga s. leachii:* 1, Sonarate (Progresso), 15 October 1948, Luis de la Torre. EL SALVADOR.—From "*Glossophaga soricina* or *Carollia* sp.": 1, near Santa Tecla (Libertad), Felten [SNI]. From *Glossophaga soricina:* 1, Mineral Encuentro, 19 June 1953, H. Felten [SNI]. BRITISH HONDURAS.—From *Carollia p. azteca:* 1, Belize, 7 October 1939, Ivan T. Sanderson. HONDURAS—*Without host:* 1, Coxen Hole, Ruatan Island, 9 January 1940, D. D. Davis, Field Museum-Leon Mandel Caribbean Expedition.

OTHER MATERIAL EXAMINED: COLOMBIA.—From *Carollia perspicillata:* 1, Río Raposo, 10 July 1962, C. J. Marinkelle. VENEZUELA.—From *Carollia subrufa:* 1, Rancho Grande, El Limon (Aragua), 21 March 1960, 3576 feet elevation, C. O. Handley, Jr. From *Carollia p. azteca:* 1, same locality and collector, 30 March 1960; 4, Guacharo Cave ("Cerro de la Cueva"), C. Monagas, 16 August 1962 [FCUCV]. From *Artibeus lituratus:* 1, 38 km.

south of El Dorado (Bolivar), 2 August 1962, Ojasti [FCUCV]. TRINIDAD [TVL, T.H.G. Aitken, unless otherwise indicated].—From *Carollia p. perspicillata:* 1, Moko Estate, Maraval, 27 November 1956; 1, Masson Hospital, Port-of-Spain, 5 December 1956; 1, Arena Forest, Brazil, 8 January 1957; 4, Arena Trace (Los Lomas), east of Cunupia, 5 September 1957; 1, Marocas Valley, 7 November 1954; 1, Belmont Valley Road, Port-of-Spain, 26 February 1958; 4, Coroney Cave no. 1, Blue Range, Diego Martin, 5 May 1958; 1, Las Lomas, 27 June 1958; 6, La Fontaine Cave, Petit Valley, Diego Martin, 13 and 20 March 1959; 1, Waller Field, 5 July 1956; 1, near San Rafael, 17 February 1947, F. Wonder, CNHM Trinidad Zoological Expedition (1947). *Without host:* 3, Melapo Forest, 9 March 1956, W. G. Downs. TOBAGO.—From *Carollia p. perspicillata:* 2, Fort George, Scarborough, 2 September 1956. BRITISH GUIANA.—*Without host:* 7, Georgetown, 18 August 1924, A. E. Emerson. SURINAM.—From *Carollia* sp.: 1, Krakka-Pdehra Road (Surinam), 25 October 1962, B. Malkin. BRAZIL.—From *Carollia perspicillata:* 1, Rocha (São Paulo), 9 September 1961, A. M. Olalla.

REMARKS: As may be judged from the above records, the normal hosts of this fly are species of *Carollia.* The fairly numerous but scattered records from other hosts reflect the ubiquity of the principal host, *C. perspicillata* (see "Host-parasite Relationships," below).

Strebla altmani Wenzel, new species. Figure 123G, 137A.

Distinct from all other species that have short inner occipital setae in that these are all fine setae, none are spinelets; the male gonapophyses, too, are distinct in that they are rather abruptly narrowed and tapered from mid-length to apex.

DESCRIPTION: *Head.*—Detached frontoclypeal plates very small and weakly sclerotized, difficult to see even in alcohol specimens. Anterior plates of laterovertices with about six setae; postocular sclerite distinct. Dorsal surface of postgenae not emarginate laterally; with about ten short bristles, a long, conspicuous bristle near inner posterior margin and lateral to this a medium bristle. Postvertex and occiput as illustrated (fig. 123G) except that all of occipital setae are fine (not spinelets as shown). Eyes multifaceted and projecting, about six large facets visible from above. Ventral antectenidial area approximately as wide as long (17:17 or 17.5).

Thorax (fig. 137A).—Second pigmented suture of prescutum present; epaulets with four or five setae; prescutal setae relatively sparse and more or less uniformly distributed, setose area extending to epaulets along sides; arc of long setae present but not conspicuous; two or three irregular transverse rows of setae between transverse sutures. Scutum with two transverse rows of discal setae anterior to the row of subequal antescutellar setae. *Wings.*—Fifth longitudinal vein bare for a short distance before base, the bare area less than half as long as that of sixth vein. Costa without apical macroseta. R_s more than twice as long (17.5:7.5) as distance from fork to crossvein *r-m. Legs.*—Pro- and mesotibiae dorsally with a double row of longer setae, only one or two of these on each side stronger than the others (three on inner edge of mesotibiae). Metatibiae with two subapical macrosetae preceded by a double row of setae that are much shorter and finer than the macrosetae but much longer than other tibial setae. Ventral surface of first segment of hind tarsi with two or three irregular rows of plantar setae, these not heavily pigmented and scarcely heavier than those of following segments.

Abdomen.—Anterior face of tergum I+II with one short seta; inner dorsal margin of lateral lobes with three or four fine setae. *Female:* Tergum VII with two macrosetae and posterior to these a pair of setae that are half as long. Supra-anal plate small, with four long apical setae only. Seventh sternites with nine or ten setae including three or four macrosetae. A small crescent-shaped postgenital sclerite present anterior to ventral arc; arc with two short and two minute setae. *Male:* Sternum VI very short, with only one transverse row of discal setae at middle, two laterally in addition to apical marginal setae. Hypopygium as in *carolliae* n. sp. Gonapophyses very slender, curved, apices not knobbed, with microsetae scattered along sides; macrosetae extending nearly to apex.

Measurements:	BL	TL	WL	WW
Male	1.40–1.49	0.49–0.52	1.10–1.13	0.51–0.55
Female	1.59–1.95	0.56–0.59	1.24–1.31	0.63–0.65

TYPE MATERIAL: Holotype male (slide) and allotype female (slide) (host no. 4191) from *Lonchorhina aurita aurita,* mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 9 September 1959, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—From *Lonchorhina a. aurita,* 208 flies (37 lots, 47 bats) as follows: 163 (29 lots, 31 bats), same data as the holotype; 26 (10 bats), same data but 25 November 1959; 13 (5 bats), railroad culvert east of Summit Golf Club (Canal Zone), 26 October 1959; 6 (1 lot), two miles north of Summit, 17 April 1957 [USNM]. From plastic bag containing *Carollia p. azteca* and *Lonchorhina a. aurita:* 25, mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 25 November 1959. From *Macrophyllum macrophyllum,* 108 flies (19 lots, 46 bats) as follows: 83 (18 lots, 21 bats), Fort Davis (Canal Zone), 13 October 1959; 25 (25 bats), same locality, 29 July 1960; 21 (9 bats), Natural Bridge, Madden Dam (Canal Zone), 31 August 1959; 2, Río Tuira (Darién), 10 March 1958, P. Galindo [GML]; 2 (2 bats), culvert, Chepo Road (Panamá), 12 October 1959. From *Carollia p. azteca:* 1, air raid shelter, Fort Davis (Canal Zone), 6 October 1959; 20 (13 bats), mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 9 September 1959; 8 (18 bats), same locality, 25 November 1959; 1, railroad culvert east of Summit Golf Club (Canal Zone), 26 October 1959; 2 (2 bats), Buena Vista Cave (Colón), 3 September 1959. From *Trachops c. cirrhosus:* 1 (15 bats), culvert, Chepo Road (Panamá), 24 May 1960. From *Pteronotus parnellii fuscus:* 1, mine shaft, Coco Plantation, Gamboa Road (Canal Zone), 25 November 1959. From unidentified host (probably *Macrophyllum macrophyllum*): 1, Natural Bridge, Madden Dam (Canal Zone), 31 August 1959.

Non-Panamanian paratypes.—From *Lonchorhina aurita:* 12 (4 lots), Rancho Grande (Aragua), VENEZUELA, 18 July, 7 and 12 August 1949, Dr. J. Racenis [FCUCV]. Paratypes to be deposited in the collections listed on p. 410.

REMARKS: *S. altmani* appears to be a normal parasite of both *Lonchorhina aurita* and *Macrophyllum macrophyllum,* closely related genera of phyllostomine bats. We are unable to distinguish between specimens from these two hosts. However, it appears to occur in larger numbers per individual host bat on *Lonchorhina* than on *Macrophyllum* (See "Host-parasite Relationships"). It also occurred consistently on *Carollia p. azteca,* in larger numbers than one would expect if these were merely strays or transitory transfers, but only where *Carollia* was roosting with one of the normal hosts. It was never taken on *Carollia* in the absence of one of these hosts.

This species is named in honor of Lt. Col. Robert M. Altman, in recognition of his important contributions to our knowledge of the ectoparasites of Panama, especially his initiation of a systematic survey.

Strebla alvarezi Wenzel, new species. Figures 123E, F; 137B.

Closely related to *carolliae* n.sp., but easily distinguished from that species by its smaller size, the shape of the anterior margin of the postvertex (fig. 123E, F) which is not broadly blunt as in *carolliae* (fig. 122A), the much smaller detached frontoclypeal plates, and the less strongly curved male gonapophyses.

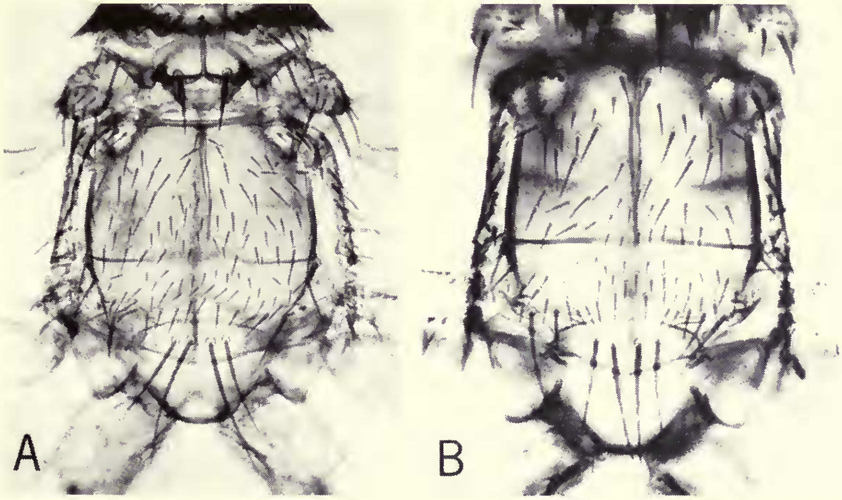

Fig. 137. Thorax, dorsal view. A, *Strebla altmani*, new species, male paratype from *Lonchorhina aurita* (no. 4220), mine shaft, Coco Plantation, Gamboa Road (Canal Zone). B, *Strebla alvarezi*, new species, paratype male from *Micronycteris megalotis* (no. 7955), near Huile (Canal Zone).

DESCRIPTION: *Head.*—Frontoclypeus with apical detached plates small, wider than long. Anterior plate of laterovertices with six setae. Postocular sclerite not differentiated. Postgenae not emarginate laterally, posteriorly with eight or nine short setae, a conspicuously longer seta near inner posterior margin, and lateral to this, a seta of intermediate length. Eyes multi-faceted and projecting, about seven facets visible from above, the upper ones not very distinct. Ventral ante-ctenidial area a little wider than long (17.5:14.5). Postvertex and occipital lobes as in fig. 123E, F.

Thorax (fig. 137B).—Prescutum with well-defined second pigmented suture; epaulets consisting of four setae; prescutal setae sparse, setose area not reaching epaulets; arc of longer setae present; two transverse rows of setae laterally between transverse mesonotal and second pigmented suture. Scutum with about eight subequal antescutellar setae and two short median ones, in addition to a long macroseta each side, in addition to the discal setae. *Wings.*—Seta at apex of costa not conspicuously long. R_s about three times as long (22:7) as distance from fork to crossvein *r-m;* R_s and fifth longitudinal vein bare basally but not as extensively as sixth. *Legs.*—Protibiae dorsally with three macrosetae on inner edge and two on outer; mesotibiae similar. Metatibiae with two macrosetae on apical third, preceded by a row of gradually smaller setae, the basal one scarcely longer than the numerous short tibial setae. Ventral surface of first segment of hind tarsus with three irregular, longitudinal rows of plantar bristles, these not heavily sclerotized, distinctly longer and heavier than those of following segments, though these are not minute.

Abdomen.—Dorsal inner margin of lateral lobes of tergum I+II with three to five setae. Dorso-lateral connexival setae scarcely longer than those of venter. *Female:* Tergum VII with a pair of macrosetae and, posterior to these, a pair of shorter setae. Supra-anal plate with four apical macrosetae only. Seventh sternites with seven to nine setae, three of them much longer than the others. Ventral arc triangularly but not strongly produced anteriorly, with four setae, two larger, two minute. *Male:* Sternum V with two transverse rows of discal setae in addition to long marginals. Sternum VII+VIII dorsally with a macroseta on each side; tergum IX dorsally with a single macroseta on each side. Gonapophyses long, slender, straight on basal two-thirds, curved on apical third; sides apically with scattered microsetae, apices rounded; ventral macroseta inserted at about basal third, extending about two-thirds the distance to apex; accessory seta minute.

Measurements:	BL	TL	WL	WW
Male	1.59–1.76	0.58–0.59	1.10–1.21	0.55–0.60
Female	1.92–2.14	0.63–0.67	1.35–1.37	0.63–0.66

TYPE MATERIAL: From *Micronycteris megalotis:* Holotype male and allotype female (slides) from host no. 7961, taken from culvert under Borinquen Highway near Empire Range, 24 October 1961, C. M. Keenan and R. L. Wenzel. In the collection of Chicago Natural History Museum. Paratypes.—4 males, 1 female, in road culvert one-half mile SE of Empire Range (Canal Zone), 23 October 1961, R. L. Wenzel and C. M. Keenan; 2 males (2 bats), "French Vault," west bank of Canal, 300 yards east of Empire Range, 23 October 1961, same collectors; 2 males, 2 females (5 bats), same data as holotype; 1 male, 1, sex unknown (2 bats), hollow espavé tree, Huile (Canal Zone), 19–20 October 1961, same collectors; 1 male, Loma Boracho (Canal Zone), 20 September 1959; 1 male, Casa Tilley, Cerro Punta (Chiriquí), 23 January 1960; 1 male, Isla Taboga (Panamá), 21 October 1959; 1 female, Guánico (Los Santos), 27 January 1962. From *Micronycteris nicefori:* 3 males, Almirante (Bocas del Toro), 12 February 1960. From *Micronycteris sylvestris:* 2 males, Armila (San Blas), 12 March 1963, C. O. Handley, Jr. and F. M. Greenwell. From *Saccopteryx bilineata:* 4 males (2 bats), hollow tree, Chepo Road (Panamá), 8 October 1959. EL SALVADOR.—From *Saccopteryx bilineata:* 1, 5 km. E of La Libertad (La Libertad), 24 October 1953, H. Felten [SNI]. From a mixed collection of *Saccopteryx bilineata* and *Glossophaga s. leachii:* 10, coastal forest, Hacienda Nancuchiname, San Marcos Lempe (Usulutan), 25 March 1954, H. Felten [SNI]. GUATEMALA.—From *Saccopteryx bilineata:* 7, Finca Santa Cristina, 6 mi. S of Democracia (Escuintla), 20 September 1948, L. de la Torre, CNHM Guatemala Zoological Expedition (1948). Paratypes to be deposited in the collections of Chicago Natural History Museum; the United States National Museum; the Gorgas Memorial Laboratory, Panamá; the Environmental Health Branch, U. S. Army, at Corozal (Canal Zone); and the Senckenberg Naturforschende Institut, Frankfurt a/Main.

OTHER MATERIAL EXAMINED: A badly damaged specimen, without host, "Río Waupes, BRAZIL," collected by the Olalla brothers [LI-13, MCZ]; an additional male lacking head but probably this species, from *Micronycteris* *megalotis,* Casa Tilley, Cerro Punta (Chiriquí), PANAMA, 6 March 1962.

REMARKS: The specimens from Guatemala have the anterior margin of the postvertex somewhat more pointed (fig. 123F) than those from Panama, (fig. 123E) and they are on the average somewhat smaller. However, we consider them to be the same. The length and disposition of the occipital setae vary, within both populations.

S. alvarezi seems to normally occur on species of *Micronycteris* and on *Saccopteryx bilineata,* bats which belong to different families. This is probably accounted for by the fact that they often roost in close proximity. *S. bilineata* roosts on the shaded outside of logs, tree trunks, and branches, and in houses, caves, etc., while *M. megalotis* (and perhaps other species of *Micronycteris*) roosts inside logs, stumps and tree holes, and in houses, culverts, etc.

S. alvarezi is named for Mr. Vicente Alvarez, of the Environmental Health Branch, USAFSC, at Corozal (Canal Zone), in grateful appreciation of his valued assistance on this project.

Genus **Paraeuctenodes** Pessôa and Guimarães

Paraeuctenodes Pessôa and Guimarães, 1937, Ann. Fac. Med. São Paulo, 12, (2), pp. 257–258. Jobling, 1939, Arb. Morph. Tax. Ent., 6, (3), pp. 269 (discuss.), 270 (keyed). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 417 (keyed); 1942, Bol. Ent. Venez., 1: 85 (keyed). Jobling, 1947, Parasitology, 39: 322 (keyed). Hoffman, 1953, Mem. Congr. Cient. Mex., 7: 179 (keyed), 189.

Type-species: *Paraeuctenodes longipes* Pessôa and Guimarães, 1937.

This genus contains a single described species, *P. longipes* Pessôa and Guimarães (op. cit., p. 258). The holotype female was taken from *Lonchoglossa ecaudata* at Ipiranga, São Paulo (São Paulo), Brazil, and the allotype male from *Phyllostomus hastatus* at São Paulo. *Paraeuctenodes* resembles *Strebla* in having well-developed dorsal postgenal sclerites and in lacking a remiform postgenal seta. However, it resembles *Anastrebla* in lacking metatibial macrosetae and in having elongated hindlegs. The frontoclypeus is entire as in *Anastrebla* and in some species of *Strebla.*

There are two specimens of this genus in the collection of Chicago Natural History Museum. They appear to represent two new species. One was taken from *Carollia p. perspicillata,* near San Rafael, TRINIDAD, and the other (doubtfully associated with *Carollia p. azteca*) was collected in a small cave northeast of Cueva de Lanquin (Alta Vera Paz), GUATEMALA. Thus, it seems highly probable that a species of this genus will be found in Panama.

Anastrebla Wenzel, new genus

Type-species: *Anastrebla modestini,* new species.

Strebla (not Wiedemann, 1824), Speiser, 1900, Arch. Naturg., 66A, Bd. I, pp. 38–43, 63 (cit.), 65 (keyed). Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, 5: 26 (keyed), 31 (cit.). Kessel, 1924, Parasitology, 16: 406–409 (char.); 1925, Jour. N. Y. Ent. Soc., 33: 13 (keyed), 29 (char.). Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 653 (part.). Curran, 1934, Man. Fam. Gen. N. Am. Dipt., p. 479 (keyed); 1935, Amer. Mus. Novit., no. 765, p. 5 (keyed). Jobling, 1936, Parasitology, 28: 355 ff. (morph., syst. pos.), 370 (keyed). Pessôa and Guimarães, 1937, Ann. Fac. Med. São Paulo, 12: 235 ff. (comp. notes). Jobling, 1939, Arb. Morph. Tax. Ent., 6: 269 (discuss.). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 417 (keyed); 1942, Bol. Ent. Venez., 1: 85 (keyed). Jobling, 1949, Parasitology, 39: 322 (keyed). Hoffmann, 1953, Mem. Congr. Cient. Mex., 7: 178 (keyed), 188 (cit.). Maa, 1963, Jour. Med. Ent., 1: 385.

The name *Strebla* (q.v.) must be used for the species assigned to the genus *Euctenodes* Waterhouse by Waterhouse, Kessel, and subsequent authors. The genus *Anastrebla* is proposed for *Strebla* of Speiser (loc. cit.) and subsequent authors, not Wiedemann, 1824.

DIAGNOSIS: With the characters attributed to *Strebla* (not Wiedemann, 1824) by Kessel (1924) and by Jobling (1939 and 1949). In general, with the characters of *Strebla* Wiedemann, but differing from that genus chiefly in that the hind legs are noticeably more elongated; the metatibiae are slender and lack macrosetae. Postgenae (fig. 39D) poorly developed dorsally (well developed in *Strebla*, fig. 122) and posteriorly bearing a remiform scale (lacking in *Strebla*).

REMARKS: The species of *Anastrebla* superficially resemble those of *Paraeuctenodes* and have similar hindlegs, but the postgenae of *Paraeuctenodes* are similar to those of *Strebla*, and, similarly, lack a remiform scale.

The species of this genus appear to be restricted to bats of the subfamily Glossophaginae. The three species known to us are from *Anoura cultrata*, *A. geoffroyi*, *A. aculeata*, and *Lonchophylla robusta*. The species treated as *Strebla vespertilionis* by Speiser (1900, pp. 38–41; pl. 4, figs. 1, 2) and Kessel (1924, p. 413, figs. 1, 5, 6; 1925, p. 24 [part.], pl. 3, fig. 20, pl. 4, fig. 24) was collected from *Lonchoglossa ecaudata*. We have not seen specimens from this host, but it is clear that the species is closely related to, if not identical with *Anastrebla modestini* n. sp. The streblid figured by Jobling (1929, fig. 4; 1949, fig. 3F) as *Strebla vespertilionis* is also a species of *Anastrebla* and is distinct from any known to us. It is characterized by exceptionally short festoon spinelets on the postvertex and occipital plates. Mr. Jobling (pers. comm.) has informed us that his illustration is based on a specimen, without host or locality data, that was given to him by Hugh Scott.

KEY TO THE SPECIES OF *ANASTREBLA*

1. Eyes with a single hyaline cornea, without *externally* distinct facets. Postvertex and occiput with relatively short, heavy spine-like setae that are not noticeably tapered. Host: *Lonchophylla robusta* .... *nycteridis* n.sp.

   Eyes with seven or eight externally distinct facets, their corneae separate and distinct. Setae of postvertex and occiput longer, distinctly tapered apically, with long points. Hosts: *Anoura* spp. 2

2. Prescutum (fig. 138A) sparsely setose, the median setose area usually not extending beyond the anterior suture. Wing vein R_1 without setae on basal half or more, sixth vein with a few setae apically near the third crossvein, and usually with one to three proximal to mid-length and one or more beyond middle. Median setose area of sternum I narrow, apical margin with about 15 setae .... *modestini* n.sp.

   Prescutum (fig. 138B) more densely setose, the median setose area extending beyond the anterior pigmented suture. R_1 and sixth longitudinal wing veins bare at base only. Setose area of sternum II broader, apical margin with 20–22 setae .... *mattadeni* n. sp.

Anastrebla nycteridis Wenzel, new species. Figure 139A, B.

Closely related to *A. mattadeni* n.sp., but differing as follows: the eyes are not distinctly faceted and projecting but have only a few vague facets that are not distinct in alcohol-preserved specimens, but can be detected in slide preparation (fig. 139A); the laterovertices are much more elongated; the spinelets of the postvertex and occiput are relatively short and stout; the male gonapophyses are heavier and much straighter, only feebly curved nearly to apex (fig. 139B). The female of *nycteridis* is unknown.

DESCRIPTION (*Male*): *Head.*—Anterior division of laterovertices with seven setae, the postero-median seta a very conspicuous macroseta but shorter than in *mattadeni* and *modestini* n. spp., not reaching posterior margin of occiput; posterior division with two setae. Dorsal sclerite of postgena with a long stout seta, no longer than and inserted anterior to the remiform seta. Postvertex and occiput with ten stout spinelets (fig. 139A), the inner four pairs subequal, the outer one distinctly shorter. Eyes a single elongate hyaline lens, facets not externally distinct, though they may be discerned in slide preparations at high magnifications (fig. 139A). Ventral ante-ctenidial area about as wide as long (24:23).

Thorax.—Prescutum with anterior transverse suture. Chaetotaxy much as in *mattadeni;* with three irregular transverse rows of setae along side, the setose area extending further anteriorly along mid-line. Twelve antescutellar setae, the middle four only slightly longer than longest discal scutal setae, the outer longer antescutellars stouter, subspiniform; discal setae forming a single transverse row at mid-line and three at the sides. *Wings.*—Setae lacking along base of R_s (basal half or less) a short basal area on fourth longitudinal vein as well as the usual basal area on the sixth longitudinal vein. R_s distinctly longer (20:15) than distance from fork to crossvein *r-m. Legs.*—Hind femora longer than thorax, very similar in chaetotaxy to those of *mattadeni.*

Abdomen.—Inner dorsal margins of tergum I+II with three very fine setae. Sternum II much as in *mattadeni,* but median setose area extending only a little more than halfway to base; with about 18 marginal setae. Hypopygium essentially as in *mattadeni.* Gonapophyses (fig. 139B) similar to those of *mattadeni* and *modestini* (fig. 139D, F), but straighter and heavier.

Measurements:	BL	TL	WL	WW
Male	2.40–2.42	0.80–0.82	1.70–1.95	0.74–0.93

TYPE MATERIAL: Holotype male (slide) from *Lonchophylla robusta* (host no. 5434), Almirante (Bocas del Toro), 28 January 1960, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum. Paratype male, same host, La Laguna (Darién), elevation 2900 feet, GML; in the collection of the United States National Museum.

Anastrebla modestini Wenzel, new species. Figures 138A; 139C, D.

Distinguished from *mattadeni* by the different shape of the laterovertices and the shorter setae of the postvertex and occiput (fig. 139C), and especially by the much sparser mesonotal chaetotaxy (fig. 138A).

DESCRIPTION: *Head.*—Anterior division of laterovertex with ten setae, the postero-median one a very conspicuous macroseta; posterior division with two long bristles. Dorsal sclerite of postgena with a long macroseta, inserted anterior to remiform scale, and extending posteriorly beyond margin of head. Postvertex and occiput, together, with five pairs of heavy sub-equal but narrowly pointed spine-like setae, the pair on postvertex slightly longer than the occipitals, the outer pair only slightly shorter than the others. Eyes with about seven or eight distinct facets visible from above. Ventral ante-ctenidial area wider than long (26:20).

Thorax.—Prescutum with a second transverse suture; a pair of widely separated short setae on anterior margin; epaulets consisting of four setae; setal arc consisting of four or five strong setae that are appreciably longer than the discals; three irregular transverse rows of discal setae between the transverse and anterior sutures, the setose area not extending beyond the anterior suture. Antescutellar row consisting of 10–12 setae, the middle five shorter than the others which are stouter. Discal setae half as long to slightly longer than antescutellars, limited to a single transverse row at middle and two rows laterally. *Wings.*—Very long; R_1 lacking setae on basal half or more in *mattadeni;* R_s bare on basal third to half; sixth longitudinal vein with a few setae apically near third crossvein, and usually with one to three proximal to mid-length and one or more beyond middle, occasionally with more setae but these always much more widely separated than setae of other veins; R_s about three times as long (26:8.5) as distance from fork to crossvein *r-m*. *Legs.*—Markedly elongated, chaetotaxy very much as in *mattadeni.*

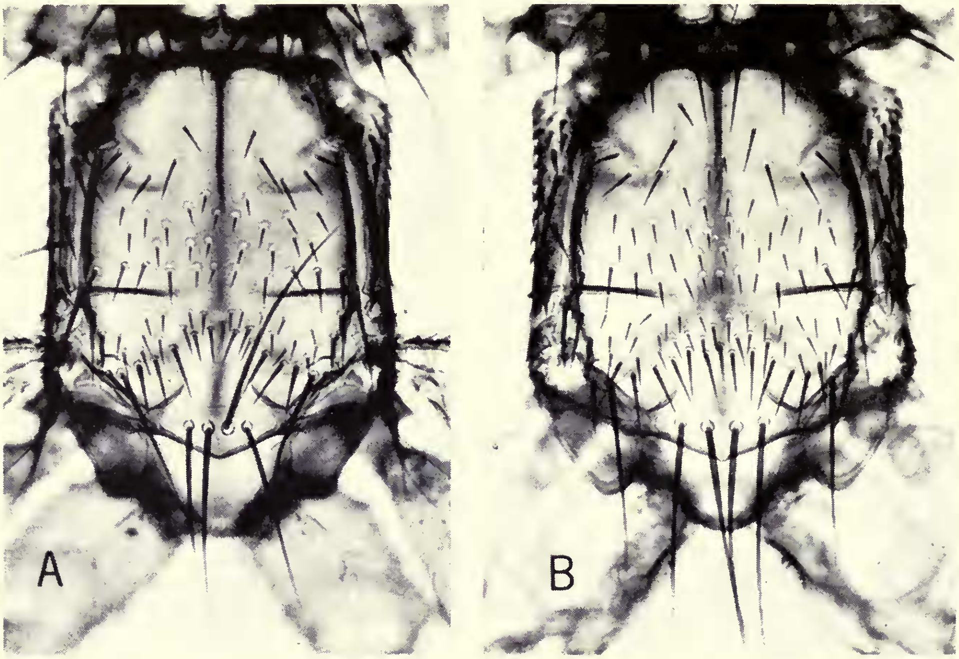

Fig. 138. Thorax, dorsal view. A, *Anastrebla modestini,* new species, male paratype from *Anoura geoffroyi lasiopyga* (no. 6218), Casa Lewis (Chiriquí). B, *A. mattadeni,* new species, paratype from *A. g. lasiopyga* (no. 5343), Rancho Grande (Aragua), VENEZUELA.

Abdomen.—Very much as in *mattadeni.* The median setose area of sternum I narrow and extending anteriorly only a little beyond middle. Apical margin with only about 15 setae, including two macrosetae; four setae between the macrosetae. *Female:* Only one or two longer setae along inner edges of dorsal setose area of dorsal connexivum, the apical one a macroseta. Chaetotaxy of tergum VII and supra-anal plate as in *mattadeni.* Ventral arc with a pair of longer setae on posterior margin, and a pair of minute ones on anterior margin; not produced, but with a microsetose nonsclerotized extension as in *mattadeni.* *Male:* Hypopygium as in *mattadeni.* The gonapophyses strongly tapered, and rather strongly curved apically; scattered microsetae along sides on about apical fourth; macroseta inserted at about basal fourth, very long, extending to apex; accessory seta well developed.

Measurements:	BL	TL	WL	WW
Male	1.98–2.17	0.77–0.82	1.92–2.06	0.77
Female	2.36	0.85	2.14	0.71

TYPE MATERIAL: PANAMA.—Holotype male from *Anoura geoffroyi lasiopyga* (host no. 6218), Casa Lewis, Cerro Punta (Chiriquí), elevation above 5000 feet, 4 May 1960, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—From *A. g. lasiopyga:* a male, Cerro Hoya (Los Santos), elevation 1500–3200 feet, 11 February 1962. GUATEMALA.—From *A. g. lasiopyga:* a male, Santa Elena (Chimaltenango), 10,000 feet elevation, 26 January 1934, F. J. W. Schmidt, Field Museum-Leon Mandel Guatemala Zoological Expedition. From *Anoura* sp. (CNHM cat. no. 73362): a male and female, San Lorenzo, 4 mi. NE of Volcan de Jumay (Jalapa), elevation 3750 feet, 15 February 1952, L. de la Torre, CNHM Guatemala Zoological Expedition (1951–52). MEXICO.—From *A. g. lasiopyga:* 1, Santa Lucia (Sinaloa), elevation 3200 feet, 28 July 1963, J. Knox Jones. TRINIDAD.—From *Anoura geoffroyi* [*geoffroyi*]: a male, Aripo Cave, 19 March 1955, W. G. Davis [RML no. 33590]; a male, Tamana Caves, 11 December 1954, C. C. Sanborn, CNHM Trinidad Zoological Field Trip. Paratypes to be deposited in the collections of Chicago Natural History Museum; the United States National Museum; and the Environmental Health Branch, USAFSC, at Corozal (Canal Zone).

OTHER MATERIAL EXAMINED: 3, without host identification, from Cueva Nanarita, Hacienda El Marne (Santa Ana), EL SALVADOR, 960 meters elevation, H. Felten [SNI].

REMARKS: *A. modestini* appears to be restricted to *Anoura geoffroyi.* It is named for Mr. Sulpice Modestin of the Environmental Health Branch, at Corozal (Canal Zone), in appreciation of his assistance in the field.

Anastrebla mattadeni Wenzel, new species. Figures 138B; 139E, F.

Easily distinguished from *A. nycteridis* n.sp. and *modestini* n.sp. by the long slender setae of postvertex and occiput (fig. 139E); from *modestini* which has similar eyes and laterovertex, it may further be separated by its very different mesonotal chaetotaxy (fig. 138B).

DESCRIPTION: *Head.*—Anterior division of laterovertex with nine or ten setae. Dorsal sclerite of postgena with a conspicuous heavy posterior macroseta which is much longer than the remiform seta and extends beyond occiput. Postvertex and occiput with five pairs of long, tapering macrosetae which are gradually shorter toward sides, the inner pair conspicuously longer than the outer. Eyes strongly projecting, multi-faceted, seven or eight facets visible from above. Ventral ante-ctenidial area much wider than long (29:21.5).

Thorax (fig. 138B).—Prescutum with pigmented suture; epaulets diagonal, with four strong short setae; arc consisting of four to five strong conspicuous setae, no discal setae anterior to them; setae of arc nearly twice as long as discals, interval between transverse mesonotal suture and second pigmented suture with four transverse rows of setae toward side, but five or six along middle, where setose area extends anteriorly to a point just beyond level of second suture. Antescutellar row of setae consisting of about 12–14 long very strong setae shorter at middle, longer laterally, the shortest one not quite twice as long as the longest discal scutal setae, of which there are a single irregular transverse row at middle and two to three laterally. *Wings.*—R_1 and R_3 without setae

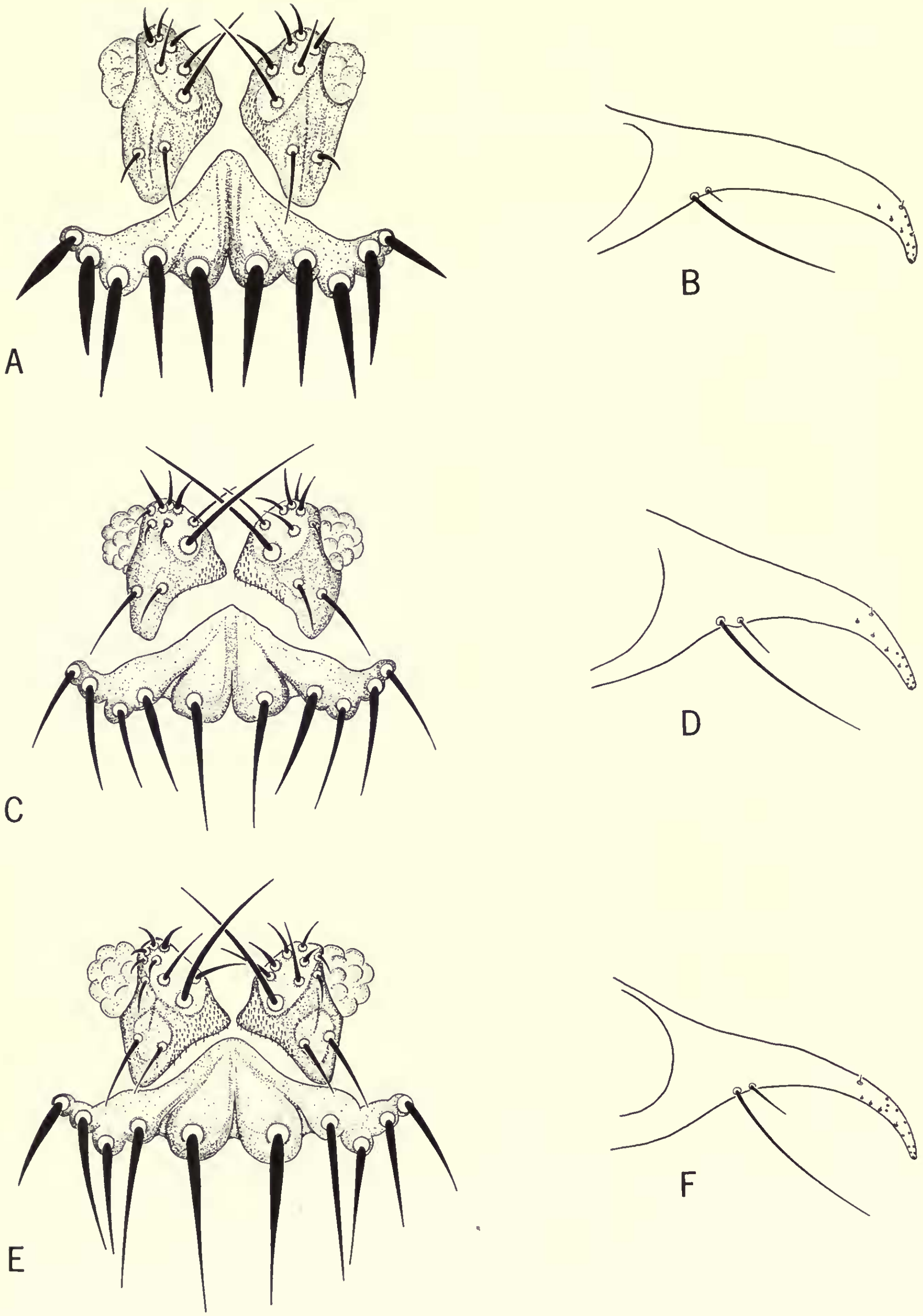

Fig. 139. A and B, *Anastrebla nycteridis*, holotype; A, laterovertices, postvertex, and occipital plates (of head); B, left male gonapophysis. C and D, *Anastrebla modestini*, new species, same structures; C, male paratype from *Anoura g. geoffroyi* (C. C. Sanborn no. 552), Tamana Caves, TRINIDAD; D, holotype male. E and F, *Anastrebla mattadeni*, new species; E, female paratype from *Anoura aculeata* (no. 5344), Rancho Grande (Aragua), VENEZUELA; F, paratype from *Anoura geoffroyi* (no. 5343), same locality.

basally, (R_s sometimes without any setae), fourth sometimes bare at base; sixth without setae basally, as usual. R_s nearly twice as long (20.5:11–12) as distance from fork to crossvein *r-m*. Third crossvein strongly bent and recurrent. Protibiae with a double row of 10–12 longer strong setae, the apical ones macrosetae; mesotibiae with 14–16 strong setae; metatibiae with short setae only. Pro- and mesofemora with a few macrosetae dorsally and laterally on apical half, metafemora with a conspicuous dorsal row of six to eight macrosetae. First segment of all tarsi as long as the next three; underside of hind tarsi with a double row of stronger plantar bristles that are longer than the others, the outer row of about four much stronger; lateral to these are minute plantars; succeeding segments with minute plantars.

Abdomen.—Dorsal inner margins of lateral lobes of tergum I+II with five to six very long, thin setae; anterior face with about five short setae. Sternum II strongly, densely setose in a median triangular area which extends to about basal fourth; apical margin with 20–22 longer setae along apical margin, two of them macrosetae, one each side of middle, with seven or eight setae between them. *Female:* Dorsal connexivum with a few longer setae at base and a few in a single row along inner margin of each lateral setose area, the others very short, about half as long as ventral connexival setae; four pairs of widely separated short segmental setae. Tergum VII with a pair of exceptionally long macrosetae; medial and posterior to these a pair of very short setae. Supra-anal plate with four apical macrosetae and just anterior to them a pair of very short widely separated setae. Seventh sternites with 11–12 long setae, five to seven of them long macrosetae, several of these exceptionally long. Ventral arc not produced, though there is a lobe-like, apparently non-sclerotized, microsetose area extending anteriorly from its dorsal edge; arc with a single pair of short setae. *Male:* Sternum V not differentiated. Hypopygium well developed, with a short seta and two or three macrosetae on each side of sternum VII+VIII, and a row of about eight macrosetae along dorsum and sides of tergum IX.

Measurements:	BL	TL	WL	WW
Male	2.05–2.14	0.77–0.82	1.84–1.92	0.77–0.82
Female	2.17–2.31	0.82	1.98–2.17	0.81–0.89

TYPE MATERIAL: PANAMA.—Holotype male (slide) and allotype female (alcohol) from *Anoura cultrata* (host no. 8593), upper Río Changena Camp (Bocas del Toro), elevation 2500 feet, 27 September 1961, C. M. Keenan and V. J. Tipton. In the collection of Chicago Natural History Museum.

Paratypes.—From *Anoura cultrata:* 15 (2 bats), Cerro Malí (Darién), elevation 4100–4800 feet, 2 and 13 February 1964, C. O. Handley, Jr.; 2 (2 bats), Cerro Tacarcuna (Darién), elevation 4100–4800 feet, 20 February and 9 March, Handley. From *Anoura geoffroyi lasiopyga:* 1, Rancho Mojica (Bocas del Toro), elevation 4800 feet, 12 September 1961. VENEZUELA (Rancho Grande [Aragua], 30 March 1961, C. O. Handley, Jr.).—From *Anoura g. lasiopyga:* 3 (2 bats). From *Anoura aculeata:* 5 (2 bats). From *Enchisthenes hartii:* 1. Paratypes to be deposited in the collections of Chicago Natural History Museum; the United States National Museum; the Environmental Health Branch, USAFSC, at Corozal (Canal Zone); the Departmento de Zoologia, Secretaria da Agricultura, São Paulo, Brazil; and the Faculdad de Ciencias, Universidad de Venezuela.

REMARKS: This species is named for Mr. Edmond Mattaden of the Environmental Health Branch, at Corozal (Canal Zone) in appreciation of his assistance in the field and in the laboratory.

A. mattadeni is recorded from three species of *Anoura.* However, we suspect that it is primarily a parasite of *A. cultrata* and *A. aculeata* and that the records from *A. g. lasiopyga* may be in error, either because of misidentification of the host or contamination in the field. The record from *Enchisthenes hartii* is obviously doubtful and probably represents a contamination.

Genus **Metelasmus** Coquillet

Metelasmus Coquillet, 1907, Ent. News, 18: 292. Costa Lima, 1921, Arch. Esc. Sup. Agric. Med. Vet., Nictheroy, 5: 26 (keyed), 32 (cit.). Kessel, 1925, Jour. N. Y. Ent. Soc., 33: 13 (keyed), 31. Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 654. Curran, 1934, Fam. Gen. N. Am. Dipt., p. 477 (keyed); 1935, Amer. Mus. Novit., no. 765, p. 5 (keyed). Jobling, 1936, Parasitology, 28, (3), p. 356 ff. (morph.), 370 (keyed); 1939, Parasitology, 31: 494 (synonymizes *Lemosia* Pessôa and Galvão, 1936); 1939, Arb. Morph. Tax. Ent., 6, (3), p. 269 (discuss.), 270 (keyed). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 417 (keyed); 1942, Bol. Ent. Venez., 1: 85 (keyed). Jobling, 1949, Parasitology, 39: 322 (keyed). Hoffmann, 1953, Mem. Congr. Cient. Mex., 7: 178 (keyed), 189 (cit.).

Lemosia Pessôa and Galvão, 1936, Revista Ent., 6: 243 (type-species: *Lemosia setosa* Pessôa and Galvão, 1936).

Type-species: *Metelasmus pseudopterus* Coquillet, 1907.

This genus contains a single species, *M. pseudopterus* Coquillet, the only brachypterous species of the subfamily Streblinae. *Metelasmus* resembles *Anastrebla* in possessing a remiform scale at the posterior margin of the dorsal sclerite of the postgena, and in lacking macrosetae on the metatibiae. However, the frontoclypeus has apical detached plates as in many species of *Strebla.*

Metelasmus pseudopterus Coquillet. Figures 39A, B; 140.

Metelasmus pseudopterus Coquillet, 1907, Ent. News., 18: 292, fig.—Sapucay, Paraguay, from *Artibeus lituratus.* (type 10293, United States National Museum). Séguy, 1926, Ency. Ent., (B), 11, Dipt., 3: 192–194, fig. 1. Stiles and Nolan, 1931, Bull. Nat. Inst. Hlth., Wash., no. 155, p. 654. Jobling, 1936, Parasitology, 28, (3), pp. 370–374 (redescr.), figs. 2, 3A–E. Jobling, 1939, ibidem, 31: 494 (synonymizes *Lemosia setosa* Pessôa and Galvão, 1936); 1939, Arb. Morph. Tax. Ent., 6 (3), p. 269 (discuss.), 270 (keyed). Bequaert, 1940, Rev. Acad. Colomb. Cienc. Exact., Fis. y Nat., 3: 418; 1942, Bol. Ent. Venez., 1: 87 (records). Jobling, 1949, Parasitology, 39: 316 ff., fig. 3C. Grandi, 1952, Introduz. Stud. Ent., 2: 478. Hoffmann, 1953, Mem. Congr. Cient. Mex., 7: 189 (records).

Lemosia setosa Pessôa and Galvão, 1936, Revista Ent., 6: 244–248, figs. 1–4.

PANAMANIAN MATERIAL EXAMINED: 49 flies, 38 lots, from more than 48 bats. From *Artibeus j. jamaicensis*, 30 lots, 41 flies (40 bats), as follows: 6 (3 bats), Almirante (Bocas del Toro), 27 January to 1 February 1960; 1, Natural Bridge, Madden Dam (Canal Zone), 31 August 1959; 2, Barro Colorado Island (Canal Zone), 10 December 1956 [USNM]; 2, Punta Piña (Darién), 24 March 1960; 7 (4 bats), Río Seteganti (Darién), 31 January to 5 February 1961; 2 (2 bats), Río Tuira, 25 and 26 February 1958, P. Galindo [GML]; 6 (4 bats), La Laguna (Darién), 2 to 15 June 1963, GML; 5 (5 bats), Tacarcuna (Darién), 20 June to 12 July 1963, GML; 8 (7 bats), Cerro Hoya (Los Santos), 8 to 24 February 1962. From *Artibeus lituratus palmarum:* 2 (2 lots), Barro Colorado Island (Canal Zone), 2 and 3 January 1957. From *Carollia perspicillata azteca:* 2 (2 bats), Almirante (Bocas del Toro), 24 and 30 January 1960; 1, Tacarcuna (Darién), 2 September 1958, GML. From *Vampyressa nymphaea:* 1, Río Mono Camp (Darién), 25 July

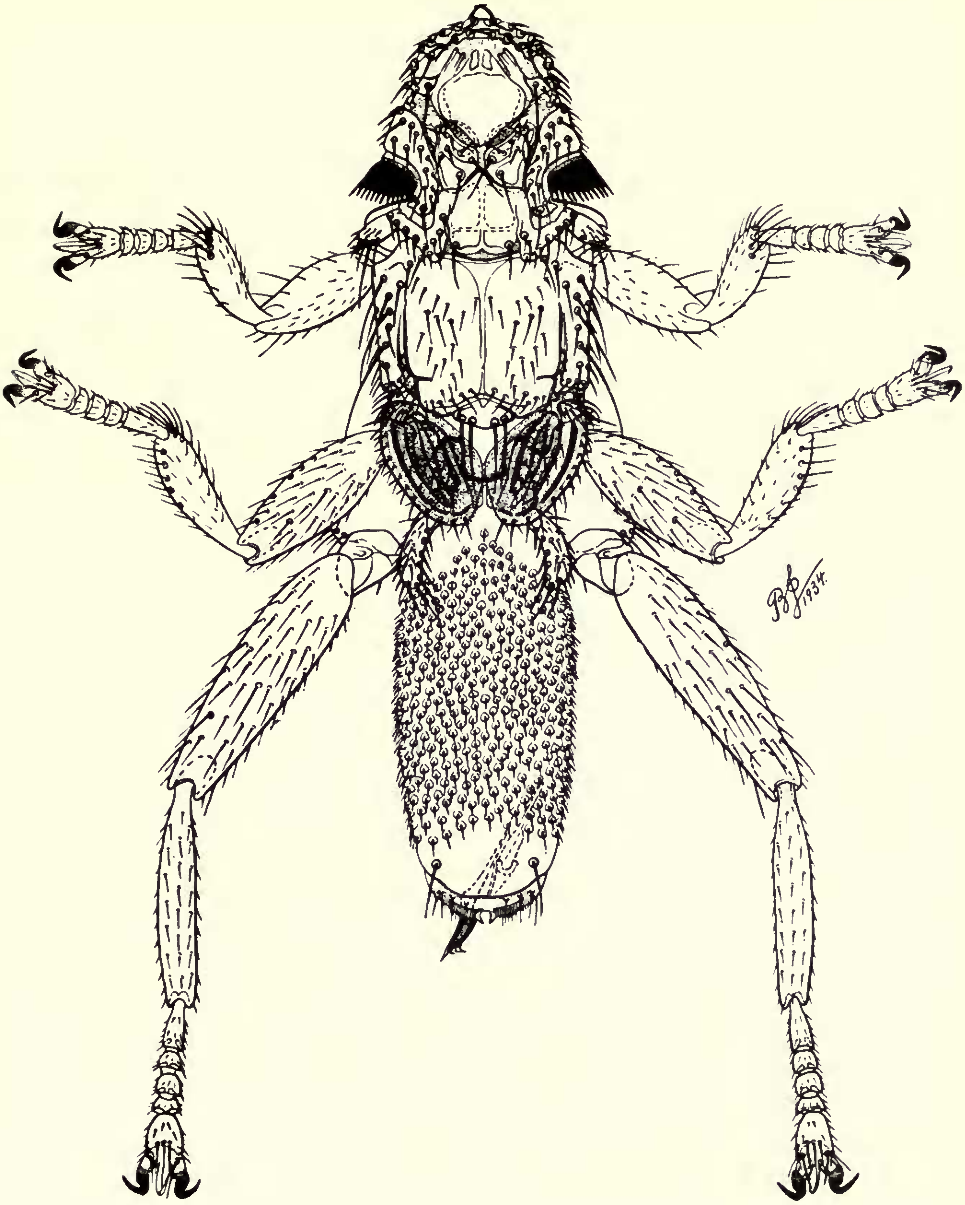

Fig. 140. *Metelasmus pseudopterus* Coquillet, male, dorsal view. From Jobling (1936).

1963, GML. *Without host:* 2 (2 lots), Tacarcuna (Darién), 20 June 1963, GML.

NON-PANAMANIAN MATERIAL EXAMINED: BRAZIL.—From *"Artibeus jamaicensis literatus":* 3, Joinville (Santa Catharina), 8 May 1929. GUATEMALA (CNHM Guatemala Zoological Expedition, 1948).—From *Artibeus j. jamaicensis:* 1, Cueva de Los Ladrones, Finca Los Arcos (Escuintla), 27

September 1948, L. de la Torre. From *Sturnira lilium parvidens:* 1, Finca El Zapote, Zapote (Escuintla), 2400 feet elevation, 14 July 1948, R. D. Mitchell and L. de la Torre. MEXICO.—From *Artibeus jamaicensis:* 1, Cueva de Zapaluta (Chiapas), 5000 feet elevation, 26 June 1960, D. C. Carter. From *Enchisthenes hartii:* 1, La Catarina, 2 miles north of Ciudad Guzman (Jalisco), 11 December 1954, L. de la Torre, CNHM Mexican Zoological Field Trip (1954).

REMARKS: *M. pseudopterus* appears to be a parasite of stenodermine bats, especially of the genus *Artibeus.* The records from *Carollia* may represent contaminations. The specimen taken from *Enchisthenes hartii* in Guatemala may represent a second, very closely related new species.

HOST PARASITE RELATIONSHIPS

Definitions

The semantic difficulties in discussing host-parasite relationships are considerable. Terms such as *principal, primary, true, secondary, original, exceptional,* and *normal,* as applied to hosts reflect the attempts to categorize relationships that in a sense cannot be categorized. Yet these terms may be valuable, if their use is clearly understood.

We have used the terms host specificity and host-parasite specificity "in relation to the [taxonomic] range of hosts" (Rogers, 1962, p. 219). However, as Caullery (1952, p. 182) has emphasized, one must recognize the distinction "between specificity in fact and in principle."[12] It is also necessary to distinguish between apparent specificity, based on limited observations, and specificity based on extensive observations throughout the geographic range of the parasite.

Several terms have been used to describe the range of hosts of a parasite: *monoxenous* for species which are restricted to a single host; *oligoxenous* for species which have moderate specificity (Rogers, loc. cit.); and *polyxenous* for species with low specificity. The term oligoxenous has been applied both to species that normally occur on two or more unrelated hosts and to those which occur on closely related ones. Perhaps the term *stenoxenous* should be used for the latter. Thus, *Trichobius joblingi, Speiseria ambigua,* and *Strebla carolliae,* which are characteristic parasites of species of *Carollia,* would be stenoxenous, while *Trichobius dugesioides,* which is a characteristic (see below) parasite of *Trachops cirrhosus* but also occurs on *Carollia p. azteca* and possibly *C. subrufa,* would be oligoxenous (see "Host specificity," below).

Oligoxenous and polyxenous and perhaps even stenoxenous species would in most instances probably have *preferred* hosts, but a preferred host may not be the most *suitable* host, i.e., the host on which the parasite has the greatest reproductive success (see Haas, 1965). Given sufficient time and opportunity for adaptation by the parasite, the most suitable host or hosts would in most instances become the preferred host or hosts in a given geographic area. Except in rare instances, use of the term "preferred" for a host has been inferential and not based on extensive observation or experimental evidence. We have used the terms *principal* or *primary* to indicate the host to which the largest number of records apply. It may or may not be the most suitable host or the preferred host but may simply reflect the known records. Needless to say, these reflect the history and accidents of collecting, and relative abundance of hosts.

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[12] "The first is specificity shown by the direct observation of natural phenomena; the second that which results from experiment." (Caullery, loc. cit.)

When Jobling (1949) summarized what was known about the host-parasite relationships of New World Streblidae, he referred to Streblidae that normally occur on more than one host as being *heteroxenous.* We do not use this term because it is generally applied to parasites which complete their cycle of development only by passing through (or on) two or more (intermediate and definitive) successive hosts (see Caullery, op. cit., p. 127). This term would properly apply to most ticks.

We found it convenient to use Caullery's (op. cit.) distinction between *normal* and *exceptional* hosts. The latter would run the gamut from transitory or temporary hosts to hosts of very low preference. We would not include disturbance transfers and contaminations under this category. Similarly, we referred to parasites which regularly and consistently occur on a host (though not necessarily with a high degree of preference for it) as its *characteristic* or *normal* parasites, the others as *exceptional* parasites.

Species of the same genus, which occur together on the same host species, we refer to as *synoxenous,* and those which occur on different hosts in the same or different geographic areas as *alloxenous.* Alloxenous species may be either sympatric or allopatric.

We suggest that the terms *host limitation* and *host-limited* be used to refer to the extent to which the parasite, throughout its life cycle, is directly dependent upon and associated with the host. Thus, holometabolous insects with free-living young, like fleas, exhibit a low degree of host limitation. Batflies, which are pupiparous and generally leave the host only long enough to pupiposit or mate, exhibit a high degree of host limitation. Anoplura and Mallophaga are host-limited, since all stages of the life cycle are directly dependent upon the host.

Host Specificity

Perhaps the greatest single need in determining the degree of host specificity in fact, is for sufficiently large and carefully made, geographically representative collections that enable one to statistically evaluate the frequency with which a parasite is found on a given host or hosts. The literature is replete with host-parasite lists which are not and cannot be evaluated. For groups like the Anoplura and the Mallophaga which are host-limited and exhibit an extraordinarily high degree of host specificity, the problem is of an entirely different order than for Siphonaptera which are much less host-limited, or for the Streblidae. The Streblidae are for the most part winged and thus quite mobile. Further, their hosts tend to roost in association with other species. The number of exceptional associations and of contaminations due to pooled collecting are relatively high, even for species which prove to be monoxenous.

Thus, in the absence of quantitative data, it is difficult to determine the degree of host specificity, even if the parasite is monoxenous or oligoxenous, especially if their hosts are ubiquitous. For such hosts may not only acquire the parasites of other hosts, but their parasites in turn may transfer, with varying degrees of ease, to other hosts with which the normal host roosts (hosts whose ecological adjustments most nearly approach those of the normal host) or to hosts which are taxonomically related.

The Streblidae of bats of the genus *Carollia* illustrate these points. In Panama, three species of *Carollia* were collected. *Carollia perspicillata* is one of the commonest and most widespread bats in the lowland tropics of Central and South America. It is tolerant of a wide variety of lowland ecological conditions. Because it is catholic in its selection of roosting sites, it comes to roost in association with a wide variety of bats. In Trinidad alone, where the bat fauna (62 species) is somewhat limited by comparison with the mainland, Goodwin and Greenhall (1961) recorded roosting associations of *C. p. perspicillata* with 23 other species of bats. The same ecological amplitude is shown by *C. p. azteca* in Panama.

Carollia castanea, on the other hand, though a common lowland species, is more limited ecologically, and thus in its roosting sites, than *C. p. azteca. Carollia subrufa* is also an abundant bat in certain lowland localities, but again is more restricted ecologically than *C. p. azteca.* It also occurs at higher elevations than either *azteca* or *castanea,* especially above 3000 feet, where the number of species, of both bats and streblids, are sharply reduced. Thus, by comparison with *azteca,* the opportunities for parasite exchange between *C. subrufa* or *C. castanea* and other bats are greatly reduced.

The records of Panamanian Streblidae reflect the differences in ecological amplitude of these hosts. Fifteen species were collected from *C. p. azteca,* four from *C. subrufa,* and three from *C. castanea.* Three—*Speiseria ambigua, Strebla carolliae,* and *Trichobius joblingi*—occurred on all three hosts. As can be seen from table 6 and fig. 141, they were the predominant flies on *Carollia p. azteca.* They were the only species on *C. castanea.* These data suggest that they are characteristic or normal parasites of bats of the genus *Carollia,* possibly of all Carolliinae, and that other species (all of which show high numerical values for other hosts) are either exceptional parasites, or represent contaminations or errors. If this is true, then these three species should occur only infrequently, as exceptional parasites or contaminations, on hosts other than *Carollia.* This is indeed the case. Conversely, this apparently is also true for the 12 other species reported from *Carollia.* Nearly all of them are from hosts with which *Carollia* may roost, and they show the same high incidence of parasitization for their normal hosts, as do the species characteristic for *Carollia* on *Carollia.* The bar graphs in fig. 141 show the incidence of parasitization by streblid species, of *Carollia p. azteca* and seven hosts (among many) with which it

TABLE 6. STREBLIDAE FROM BATS OF THE GENUS *CAROLLIA*, ACCORDING TO SPECIES

	A Number of bats parasitized	B Percent of bats parasitized	C Percent of streblid-infested bats	D Number of Streblidae taken	E Percent of all Streblidae on host
Carollia p. azteca 339 considered; 284 (83.8%) parasitized by Streblidae					
Trichobius joblingi	282	83.18	99.29	1104	74.44
Speiseria ambigua	99	29.20	34.85	160	10.78
Strebla carolliae	100	29.49	35.21	121	8.15
Trichobius dugesioides	38	11.20	13.38	53	3.57
Strebla altmani	19	5.60	6.69	29	1.95
Trichobius yunkeri	3	0.88	1.05	3	0.20
Metelasmus pseudopterus	3	″	″	″	″
Aspidoptera busckii	2	0.58	0.70	2	0.13
Trichobius macrophylli	″	″	″	″	″
Aspidoptera delatorrei	1	0.29	0.35	1	0.06
Mastoptera guimaraesi	″	″	″	″	″
Nycterophilia parnelli	″	″	″	″	″
Trichobius dugesii	″	″	″	″	″
″ *johnsonae*	″	″	″	″	″
″ *sparsus*	″	″	″	″	″
Carollia castanea 36 considered; 34 (99.4%) parasitized by Streblidae					
Trichobius joblingi	34	94.44	100.00	78	86.66
Strebla carolliae	6	16.66	17.64	6	6.66
Speiseria ambigua	4	11.11	11.76	6	6.66
Carollia subrufa 30 considered; 19 (63.3%) parasitized by Streblidae					
Trichobius joblingi	18	60.00	94.73	66	91.66
Speiseria ambigua	4	13.33	21.05	4	5.55
Strebla carolliae	1	3.33	5.26	1	1.38
Trichobius dugesioides	1	3.33	5.26	1	1.38

commonly roosts, in Panama. The eight species of bats belong to the family Desmodidae and four subfamilies of Phyllostomidae. The implications need no further explanation. The very low incidences mostly represent transitory transfers, or other nonspecific associations, but some undoubtedly represent errors or contaminations due to collecting techniques. It is to be expected that a large percentage of exceptional species will be reported

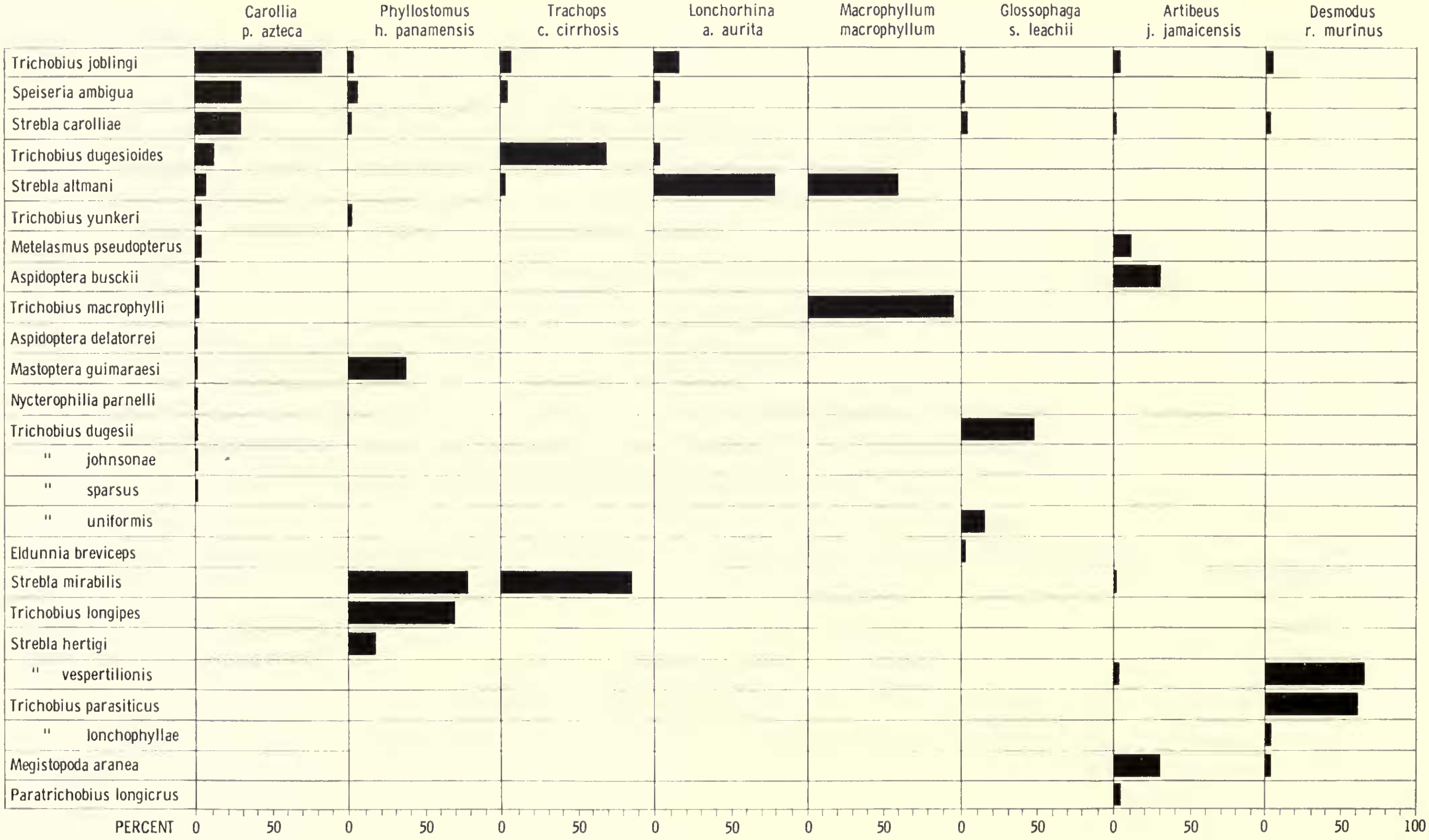

Fig. 141. Incidence of Streblidae on eight species of bats in Panama (in percent of specimens of each host species parasitized).

from ubiquitous hosts, because of the more numerous opportunities for transfer of parasites from other bats. There will also be a larger number of contaminations and errors recorded for them, simply because more are collected. It will be noted that some of the parasites listed in fig. 141 (like *Trichobius yunkeri, T. johnsonae,* and *Nycterophilia parnelli*) are characteristic parasites of other hosts, like *Pteronotus* spp., which are not included in the figure.

Two species of Streblidae, *Strebla altmani* and *Trichobius dugesioides,* which appear to be characteristic parasites of other hosts, occurred in significant numbers on *C. p. azteca. S. altmani* appears to be characteristic of both *Lonchorhina aurita* and *Macrophyllum macrophyllum,* related genera of Phyllostominae. Although it was taken on 5.6% of the *Carollia p. azteca* considered, it apparently did not occur on *Carollia* in the absence of one of the normal hosts. *T. dugesioides* appears to represent a more complicated situation. It parasitized 67% of the specimens of *Trachops cirrhosus* examined (table 7) and constituted 84% of the Streblidae on that host, but it parasitized only 11.2% of *Carollia p. azteca* and constituted only 3.57% of the Streblidae on that host. Records indicate that it is an exceptional parasite of other hosts. *Trachops cirrhosus* and *Carollia p. azteca* often roost in the same sites.

TABLE 7. INCIDENCE OF *TRICHOBIUS JOBLINGI* (*j.*) AND *T. DUGESIOIDES* (d.) ON *CAROLLIA PERSPICILLATA AZTECA* AND *TRACHOPS CIRRHOSUS CIRRHOSUS* IN PANAMA.

	A Percent of hosts parasitized		B Number of flies collected		C Percent (of all Streblidae on host)		D* Mean no. of flies per host	
	j.	d.	*j.*	d.	*j.*	d.	*j.*	d.
Trachops cirrhosus 55 bats considered; 54 (98.2%) parasitized by Streblidae	5.45	**67.27**	5	**263**	1.59	**84.02**	0.09	**4.69**
Carollia p. azteca 339 bats considered; 284 (83.77%) parasitized by Streblidae	83.18	**11.20**	1104	**121**	74.44	**3.57**	3.87	**0.18**

*Mean no. per host = mean no. of each species per host bat parasitized by that species.

There appears to be very little transfer of *T. joblingi* from its normal host, *C. p. azteca,* to *Trachops,* while the reverse appears to be true for *dugesioides* from *Trachops* to *Carollia p. azteca.* One might assume from the data that the incidence of *T. dugesioides* on *C. p. azteca* is to be explained by a simple transfer from *Trachops,* when the two hosts roost together. This does not appear to be the case. Most of the specimens of *dugesioides* that occurred on *Carollia p. azteca* were from bats that roosted in caves and a mine shaft, typical sites for *Trachops cirrhosus.* Interestingly, no *Trachops* were recorded from these collecting sites. On the other hand, quite a different situation prevailed among hosts collected from a culvert along Chepo Road. Here, a series of seven *Trachops cirrhosus* were infested with an average of 17 *dugesioides* per bat parasitized by that species, as opposed to an average of 4.69 for all localities. Seventeen *Carollia p. azteca* were collected in this same culvert. Not a single specimen of *T. dugesioides* was taken from them! The reasons are not apparent, but several possibilities are suggested. Fifteen of the 17 *Carollia* were females; it may be that *dugesioides* is not attracted to females. However, in other localities where *Carollia* was parasitized by *dugesioides*, there was no observable difference in parasitization according to sex of the host. One may suggest, too, that transfer does not easily take place in an "unnatural" roosting site such as a culvert. Still another possibility is that this streblid has such a strong preference for *Trachops* that it will parasitize another host only if it emerges from the puparium in the absence of the normal host, for example, if the *Trachops* colony has moved to another roosting site. If this is the case, it would be most interesting to determine whether or not host-conditioning of these parasites takes place.

Analyses of host associations, similar to those shown in table 6 were used to evaluate the relationships of most of the common hosts and their Streblidae. These were the bases for determining which flies are normal or characteristic for a host in the host-parasite list (p. 663).

This is a simple approach. Much more sophisticated statistical techniques will be needed for investigating many of these problems. For example, we have not taken into consideration the size of the sample. Data have been lumped to a considerable extent. We have eliminated from consideration mixed collections or pooled collections, or collections which we definitely know to have been contaminated. The columns indicate different indices that can be used as a guide in evaluating the degree of host specificity. In general, it was our experience that if the values in Columns B, C, and E were below 1%, the records represented contaminations and errors in labeling, or disturbance transfers. Slightly higher values appeared to represent disturbance transfers or transitory associations of a non-specific nature. In most instances normal associations, including those of low host preference, gave higher values.

In general, each of the figures appears to be a valid index as to the degree of specificity. In some instances, the percentage for each species of the total number of Streblidae collected from the host, gave a better appreciation of the relationship to the host. In others, especially when populations of Streblidae on the host were small, the figures in Columns B and C gave a clearer picture. In instances where the host is parasitized only under special circumstances, the figure in Column C was more instructive. For example, *Strebla alvarezi* was taken on species of *Micronycteris* and on *Saccopteryx bilineata*, two genera of bats which often roost in close proximity (see p. 627).

The incidence of parasitization of these hosts by *S. alvarezi* (table 9) was very low. It was only 12.09% for the 124 specimens of *Micronycteris megalotis* collected, and even lower for *Saccopteryx bilineata.* The figure for *Trichobius keenani,* a species known to us only from species of *Micronycteris,* is even lower. Thus, the figures given in Column B for the over-all incidence of *S. alvarezi* could be interpreted to mean that *megalotis* is an exceptional host of this fly. However, *Micronycteris* species roost in small groups, usually in relatively exposed situations (see pp. 627 and 647), conditions probably not suitable for the maintenance of large populations of Streblidae.

If this is true, then bats from many roosting sites would be negative for Streblidae, even though the host might elsewhere be parasitized by species that are restricted to it, or to it and to closely related species. It would seem, then, that a more significant indicator of the host relationship would be a figure which at least to some degree takes this into account, e.g., one which shows the incidence of each species on those bats that were parasitized by Streblidae. Further, this eliminates from consideration host specimens which for one reason or another were not examined, or were not etherized and examined promptly enough to recover the Streblidae. The figures in Column C, then, more nearly approximate those in E and probably give a truer picture of the specificity, though not of the incidence of parasitization within the total population of the host (see p. 647).

We are in need of acceptable indices of host specificity that take into account the variables mentioned. Their development and use would be facilitated by the use of modern data processing techniques.

Analysis of the field data for all of the Streblidae indicates that *in Panama* about 55% of the species are known only from a single host; another 15% appear to be monoxenous, but occasionally occurred as exceptional parasites on other hosts; about 13.5% were stenoxenous, i.e., they occurred on bats of a single genus; and 15% were oligoxenous and normally occurred on bats of two or more genera. A few are unassignable. None were polyxenous.

This is in closer agreement with the conclusions of Ross (1961) than of Jobling (1946), though Ross dealt with only a few species, from a relatively limited area. Jobling concluded that only nine of the 36 species of New World Streblidae recognized by him were monoxenous, and that the rest were "heteroxenous," i.e., they normally occurred on more than one species of bat. His conclusions were the natural consequence of having to deal with unreliable host data and the limited collections available at the time. This made it nearly impossible to discriminate closely related species. His interesting ideas on the relationships between the roosting habits of the hosts and the Streblidae they harbored are generally valid, but his statement that a very large number of the rare forest bats are free of Streblidae is not entirely true. Also contrary to his belief, some species of Streblidae, e.g., *Trichobius macrophylli* and members of the *Trichobius caecus* group, may regularly occur in large numbers on the host, while others may do so in exceptional cases.

Although most of the Panamanian Streblidae appear to be monoxenous or stenoxenous, a preliminary study of extensive collections from Mexico indicates that toward the edge of the distribution of the family, the species tend to be less host specific, at least those that occur on cave bats. Seasonal movements, including migration, appear to be more common among bats of the temperate zone. It seems probable that cave Streblidae would have a better chance of maintaining themselves throughout the year, if they could live on whatever host was predominant at a given time. In other instances, essentially tropical hosts living near the periphery of their range in ecologically "marginal" situations, would probably be less uniformly distributed and less abundant. Other things being equal, ecological polyvalence (including host preference) would presumably be advantageous to parasites of such hosts. This would agree with findings in some other groups of ectoparasites, as well.

Parasite Faunules

Because of the high degree of host specificity, it is possible, in most cases, to identify a host by its Streblidae. This is true even when the parasites are not strictly monoxenous, because the composition of the streblid faunule of a host is distinctive. For example, *Strebla carolliae, Trichobius joblingi,* and *Speiseria ambigua* constitute a faunule that is characteristic of bats of the genus *Carollia.* If *Trichobius dugesioides* is also present, the faunule is characteristic of *Carollia perspicillata azteca* and possibly of *C. subrufa.* Similarly, *Trichobius costalimai, Trichobioides perspicillatus* and *Strebla hertigi* form a characteristic faunule of *Phyllostomus discolor,* both *P. d. discolor* and *P. d. verrucosus.*

The streblid faunule may differ between "subspecies" of the host. For example, *Trichobius longipes, Mastoptera minuta,* and *Strebla consocius* constitute the faunule on *Phyllostomus hastatus hastatus,* at least in northern South America, while *T. longipes, Mastoptera guimaraesi* and *Strebla mirabilis* constitute the faunule on *P. h. panamensis* in northwestern South America and Panama. In the lowlands of Panama (and possibly Colombia), this faunule may include *Strebla hertigi,* as well. The faunule may also vary geographically in the same subspecies. For example, in Costa Rica and Nicaragua, *Strebla mirabilis* apparently disappears from *P. h. hastatus* and is entirely replaced by *S. hertigi.*

In Panama, the number of characteristic species per host varied from one to five. Not all of them necessarily occur on each host bat or in all roosting sites or localities. Below, we have listed the number of host species collected in Panama that fell into each category.

No. of characteristic streblid species per host:	0	1	2	3	4	5
No. of host species:	51	14	21	7	6	1

These figures will change with further collecting. For example, it will probably be found that fewer than 14 hosts harbor only a single species, and that some of the hosts which were negative do have Streblidae.

Undoubtedly, many factors determine the nature of the streblid faunule on any one bat, including evolutionary history of host and parasite, physical and biotic factors of the environment (including the host), biology of host and parasite, and size of host and parasite, to list a few. In general, the largest number of species of Streblidae are recorded from hosts that are ecologically labile, especially ubiquitous hosts and/or hosts that tend to roost in sizable (sometimes very large) colonies. Among such hosts in Panama are *Phyllostomus h. panamensis, Carollia perspicillata azteca, Artibeus jamaicensis*, and *Pteronotus parnellii fuscus*. On the other hand, species of the genus *Tonatia*, which may harbor four or more species of Streblidae each, live in separate family groups! *Carollia p. azteca* had the largest number of characteristic species of any host bat in Panama.

Synoxenous Parasites

Although a little more than 70% of the host species collected harbored two or more species of Streblidae, and 35% harbored three or more, it is only rarely that an individual host bat normally harbors two species of the same genus simultaneously. When this is so, the flies are usually morphologically different types, presumably specialized for living on different body regions of the host. In those rare instances in which this does not appear to be the case, one of the two species appears to be secondarily acquired from an ecologically and/or taxonomically related host, and most if not all of these exchanges appear to be unilateral or non-reciprocal.

We have already noted that *Trichobius joblingi*, a normal parasite of *Carollia*, and *T. dugesioides*, a characteristic parasite of *Trachops* (and possibly of *Chrotopterus*), occur together on *Carollia p. azteca* and, sometimes on *C. subrufa*. On the other hand (see above), *joblingi* rarely transfers from *Carollia* to *Trachops*. Likewise, *Strebla altmani* may occur together with *S. carolliae* on *Carollia p. azteca* but only when the latter is associated with *Lonchorhina aurita*, one of the normal hosts of *altmani;* but *S. carolliae*, the characteristic *Strebla* of *Carollia*, rarely transfers to *Lonchorhina* under the same circumstances.

Trichobius johnsonae is a characteristic parasite of *Pteronotus parnellii fuscus*, and *T. yunkeri* of *Pteronotus suapurensis* and *P. psilotis*. In one instance, 27 specimens of *johnsonae* and 26 of *yunkeri* were recorded on a single specimen of *P. suapurensis*. It cannot be determined from the field data whether or not *P. p. fuscus* was also present. It may be that the collection was not taken from a single host species or individual, as represented.

Trichobius sparsus normally occurs in small numbers together with *T. johnsonae* on *Pteronotus parnellii fuscus*. However, these two species of *Trichobius* belong to different groups and probably are specialized in their feeding habits.

The only other synoxenous species of New World Streblidae that we know are the two species of *Strebla, mirabilis* and *hertigi*, that occur together on *P. hastatus panamensis* in Panama, and possibly Colombia. *S. mirabilis* typically occurs in larger numbers (see following paper, table 11 and fig. 147) as the "dominant" species, and *hertigi* in smaller numbers as the "subordinate" species. However, in Costa Rica and Nicaragua, *mira-*

TABLE 8. INCIDENCE* OF FOUR SPECIES OF STREBLIDAE ON *PHYLLOSTOMUS HASTATUS PANAMENSIS* COLLECTED AT FIVE LOCALITIES IN PANAMA.

Localities	*Strebla mirabilis*	*Strebla hertigi*	*Trichobius longipes*	*Mastoptera guimaraesi*
Chepo Road (Panamá) (hollow tree in forest) 8 Oct. (16 bats)	100.00(200)	87.50(40)	100.00(86)	93.75(113)
Chilibrillo Caves (Panamá) July & Oct. (17 bats)	76.57(206)	5.38(1)	70.58(45)	5.88(1)
Madden Dam (Canal Zone) (natural bridge and small cave. 28–29 Sept. (14 bats)	92.85(170)	14.28(1)	28.57(47)	7.13(1)
Fort Kobbe (Canal Zone) (hollow *Ficus* tree) 9 Oct. (5 bats)	100.00(77)	0.00	100.00(35)	0.00
Fort Sherman (Canal Zone) (buildings & bunkers) 4 & 6 April (19 bats)	100.00(146)	5.26(1)	47.36(43)	42.10(77)

*Shown as percent of hosts parasitized by each species. Figures in parentheses = number of specimens of each species of streblid.

bilis does not seem to occur on *P. h. panamensis* but is entirely replaced on that host by *S. hertigi.* The limited data suggest that competitive displacement is involved. The problem is discussed in the following paper.

Ecology of Parasitization

Little is known about the population ecology and dynamics of Streblidae, or their relation to parasitization of the bat hosts. However, as was pointed out (p. 426), population densities may be high for Streblidae of bats like *Pteronotus,* which roost in relatively large colonies, usually in long established sites, and low (or the parasites absent) in new or temporary sites. In general, too, as Jobling (1949b) indicated, Streblidae tend to be absent from those forest bats which roost in small numbers in exposed situations. Thus, species of Emballonuridae, in general, have few or no Streblidae, or possibly acquire them (see p. 627) from other ecologically associated bats whose roosting sites may be slightly more favorable for Streblidae. Bats like *Thyroptera,* which roost singly or in very small numbers in rolled leaves of *Heliconia* and bananas, lack these flies. Their roosting habits probably render them unsuitable as hosts for Streblidae. However, they may have Nycteribiidae of the genus *Hershkovitzia.*[13] This may be the situation, too, in *Anthorhina* and *Mimon,* the only Phyllostomidae known to us that normally harbor Nycteribiidae. Closely related phyllostomine genera are parasitized by Streblidae and have distinctive faunules. Even bats of the genus *Tonatia,* which roost in family groups, have well-developed streblid faunules. However, these bats usually roost in the interior of *Nasutitermes* nests which had been hollowed out and used as nests by parrots, and then abandoned. In such an enclosed "home," it is likely that the microclimate and other conditions are suitable for Streblidae. Further, the Streblidae would be relatively restricted, to both bat and roosting site, and the hazards of being separated from the host would be correspondingly reduced.

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[13] The Nycteribiidae appear better able to maintain themselves on hosts that roost apart from others, in relatively restricted sites and in small numbers. As a family, they also have a broader climatic tolerance and distribution than do Streblidae.

In bats whose roosting sites and habits fall between the extremes represented by *Pteronotus* and *Thyroptera,* one would expect to find considerable variance in both the incidence and density of Streblidae, especially if the host roosts in a wide variety of situations. *Phyllostomus hastatus panamensis* appears to be such a host. Table 8 shows the incidence of the four characteristic species of Streblidae of that host, based on collections made at five Panamanian localities. Forest situations appear to be most suitable for parasitization of this host by *S. hertigi* and it is probable that this fly transfers to it from *Phyllostomus d. discolor* in these habitats (see following paper, by Wenzel and Tipton). Caves appeared to be less favorable sites than the others, for all of the Streblidae of *P. hastatus panamensis.* This is interesting, because the genera and species groups of Streblidae represented on this host are characteristic of Phyllostominae, bats which as a group tend to be forest dwellers.

One can only guess at the factors that completely exclude *Mastoptera guimaraesi* from *P. h. panamensis* in a *Ficus* tree, when this fly was present in large numbers on the same host roosting in a building, and also parasitized 100% of the bats in a hollow espavé tree in a forest along Chepo Road. Further, at Fort Sherman, only four *guimaraesi* were recovered from 13 bats collected in one building, whereas 73 were taken from six bats collected in two others!

Similarly, only 14.5% of 124 specimens of *Micronycteris megalotis* collected at 27 sites throughout Panama, were parasitized by Streblidae (table 9). Yet, in an area of a few square miles near the Empire Range (Canal Zone), the senior author and Charles M. Keenan found that 64.7% of them were infested. A thousand yards (or less) away, along the road to Cocolí, the bats were equally as numerous but all were negative for these flies. More bats were collected at these sites than for which data are given, but the differences are nonetheless evident. The area in which the parasitized bats occurred included a considerable amount of forest in which there were logs and large espavé and other trees with basal tree holes, both suitable roosting sites for this bat. In the area along the road to Cocolí, where no parasitized bats could be found, the forest was mostly young "second growth." No tree holes were seen there, and all of the bats taken were roosting in culverts and similar man-made sites.

As pointed out (p. 627), *Micronycteris megalotis* roosts in small num-

TABLE 9. INCIDENCE OF STREBLIDAE ON *MICRONYCTERIS MEGALOTIS MICROTIS* IN PANAMA

	A Number of *megalotis* parasitized	B Percent of *megalotis* parasitized	C* Percent of parasitized *megalotis*	D Number of Streblidae taken	E Percent of all Streblidae on host
Empire Range Area					
6 sites: 17 bats	11	64.70			
Strebla alvarezi	10	58.82	90.90	15	65.21
Trichobius keenani	3	17.64	27.27	8	34.78
Total, excluding Empire Range Area					
21 sites: 107 bats	7	6.54			
Strebla alvarezi	5	4.67	71.42	5	50.00
Trichobius keenani	2	1.86	28.57	5	50.00
Total localities					
27 sites: 124 bats	18	14.51			
Strebla alvarezi	15	12.09	83.33	20	60.60
Trichobius keenani	5	4.03	27.77	13	39.39

*Percent of those *megalotis* parasitized by Streblidae that were parasitized by *S. alvarezi* or *T. keenani*, respectively.

bers, in *relatively* exposed situations. In natural habitats, it roosts just inside tree holes and hollow logs, but in habitats disturbed by man, it also roosts in culverts, buildings, and similar sites. In the Empire Range area, parasitized individuals were taken in all of these roosts. We think it probable that the parasites of this bat can establish and maintain themselves only in relatively undisturbed areas, where the host populations are able to roost in natural and relatively stable sites such as tree holes, and where populations of the host have maintained themselves over a considerable period of time. This would explain the absence of the parasites in such heavily disturbed areas as the one outside the Empire Range area near Cocolí.

Extensive and intensive collecting, with appropriate ecological observations, population estimates of the hosts, and other data, will provide valuable insights, but autecological studies of hosts and parasites are essential to an understanding of the problems of parasitization.

Taxonomic Concordance

It is premature to attempt a detailed study of the concordance between the classification of the Streblidae and that of their hosts. The taxonomy and morphology of the Streblidae are too imperfectly known to permit one to delineate probable phyletic relationships within the family. Still to be investigated are puparial characters, internal morphology, morphology of the reproductive apparatus, and chromosome karyotypes, among others.

Nonetheless, a tentative grouping (table 10) of the genera and species groups of the New World Streblidae, based largely on structure of the abdomen and head, reveals a number of interesting correlations with the classification of the hosts.

In the *Trichobius pallidus, caecus,* and *major* groups, the laterovertices and occipital lobes or plates of the head are poorly differentiated. They are better differentiated, but still poorly sclerotized, in *Joblingia* and *Anatrichobius.* They are well sclerotized in other genera. In Series 3, they are well differentiated, and in Series 4 (Streblinae), they reach their maximum development and differentiation.

One may question the validity of these groupings, since any of the characters on which they are based could evolve independently. We tentatively regard the insertion of the accessory setae posterior to the macrosetae on the male gonapophyses as a generalized condition, and the free cerci of the female as a derived condition. In some instances, the gonapophyseal setae are poorly differentiated; and it cannot be determined which, if any, are accessory and which are macrosetae. Likewise, it is sometimes very difficult to determine whether the female cerci are free or not. It will be necessary to further investigate these and many other characters. However, with the exception of Series 3, the series seem to be internally consistent, even though the *inter* and *intra* series relationships are not clear.

If the groupings have validity, then it appears that *Trichobius* is not a homogeneous genus. This is certainly true. The genus is sufficiently polymorphic that one can justify creating a series of separate genera or subgenera for most of the *Trichobius* groups and perhaps even further subdivide the *major* group. Some of these appear to be ancestral to distinctive evolutionary lines. For example, it is clear that *Joblingia* and *Anatrichobius* are brachypterous derivatives of the *major-corynorhini* subgroup of the *major* group of *Trichobius.* It is also reasonably clear that *Megistopoda, Paratrichobius* and *Neotrichobius* evolved from species of, or closely related to, the *Trichobius phyllostomae* group; that the *dugesii* group is closely related to and probably derived from the *longipes* group; that the genus *Trichobioides* evolved from a species of, or related to the *dugesii* group; and further that the brachypterous *Mastoptera* probably evolved from a species related to *Trichobioides perspicillatus.*

In their male and in some female characters, the Streblinae appear similar to the *caecus* group of *Trichobius.* However, they are so highly specialized in their head characters, and differ sufficiently in most female characters that, at present, we cannot demonstrate a relationship. Within the Trichobiinae, the least specialized streblids appear to be the *pallidus, caecus* and *major* groups of *Trichobius.* The male of *Synthesiostrebla* has not been examined. The general morphology and female genital structure suggest that the genus may be related to the *pallidus* group.

The female of *Stizostrebla longirostris* has not been studied, either, but its morphology suggests that it is closely related to *Pseudostrebla.* Superficially, *Parastrebla handleyi* appears very similar to *Pseudostrebla,* but in its female genital structure is very similar to members of the *Trichobius*

TABLE 10. TENTATIVE GROUPING OF NEW WORLD STREBLIDAE.

(* = recorded from Panama. ? = assignment dubious.)

DIVISION I

Subfamily NYCTEROPHILIINAE. Form flea-like. Abdominal terga I and II distinctly separated lateroventrally, fused dorsally; sterna I–VI of male represented by normally developed, similar sclerites. Male genital apparatus external.

- **Nycterophilia** Ferris, p. 432
  - *coxata* Ferris, p. 434
  - **fairchildi* n.sp., p. 436
  - **natali* n.sp., p. 438
  - **parnelli* n.sp., p. 434

DIVISION II

Subfamilies TRICHOBIINAE, STREBLINAE. Form not flea-like. Abdominal terga I and II completely fused; male sterna dissimilar, III and IV absent, V and VI often absent. Male genital apparatus internal.

SERIES 1 (TRICHOBIINAE). *Male.*—Accessory gonapophyseal setae inserted posterior to the macrosetae. Female.—Abdominal cerci articulated or fused with ventral arc; postgenital sclerite usually present.

- **Trichobius** Gervais, p. 442
  - **pallidus** group, p. 447
    - *pallidus* (Curran), p. 447
  - **caecus** group, p. 448
    - *caecus* Edwards, p. 450
    - **galei* n.sp., p. 449
    - **johnsonae* n.sp., p. 455
    - **yunkeri* n.sp., p. 453
- ?**Synthesiostrebla** Townsend, p. 429
  - *amorphochili* Townsend, p. 429

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- **Trichobius** Gervais
  - **major** group, p. 456
    - ?*adamsi* Augustson, 1943
    - *corynorhini* Cockerell, 1910
    - *hirsutulus* Bequaert, 1933
    - *major* Coquillet, 1899
    - *pseudotruncatus* Jobling, 1939a
    - (= *kesselae* Jobling, 1938)
    - **sparsus* Kessel, p. 457
    - *sphaeronotus* Jobling, 1939a
    - *truncatus* Kessel, 1925
- **Joblingia** Dybas & Wenzel, p. 507
  - **schmidti* Dybas & Wenzel, p. 507
- **Anatrichobius** n.g., p. 502
  - **scorzai* n.sp., p. 503
- ?**Parastrebla** n.g., p. 578
  - **handleyi* n.sp., p. 579

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- **Trichobius** Gervais
  - **phyllostomae** group, p. 496
    - **brennani* n.sp., p. 497
    - *phyllostomae* Kessel, p. 498
    - **vampyropis* n.sp., p. 500
- **Megistopoda** Macquart, p. 540
  - (= *Pterellipsis* Coquillet, 1899)
  - **aranea* (Coquillet), p. 542
  - *pilatei* Macquart, p. 541
  - **proxima* (Séguy), p. 543
  - **theodori* n.sp., p. 545
- **Paratrichobius** Costa Lima, p. 518
  - **dunni* (Curran), p. 527
  - **longicrus* (M. Ribeiro), p. 521
  - **lowei* n.sp., p. 528
  - **sanchezi* n.sp., p. 530
  - **salvini* n.sp., p. 532
- **Neotrichobius** n.g., p. 536
  - **stenopterus* n.sp., p. 539

SERIES 2 (TRICHOBIINAE). *Male.*—Accessory gonapophyseal setae inserted anterior to macrosetae. *Female.*—Cerci united with ventral arc; postgenital sclerite absent except in *Speiseria*.

- **Trichobius** Gervais
  - **uniformis** group, p. 459
    - **keenani* n.sp., p. 462
    - **lionycteridis* n.sp., p. 464
    - **lonchophyllae* n.sp., p. 461
    - **uniformis* Curran, p. 459
- **Speiseria** Kessel, p. 549
  - **ambigua* Kessel, p. 549

TABLE 10 (continued)

SERIES 3 (TRICHOBIINAE). Head without a complete ventral ctenidium. *Male.*—Accessory gonapophyseal setae inserted anterior to the macrosetae. *Female.*—Cerci free; postgenital sclerite absent.

Noctiliostrebla n.g., p. 560
  aitkeni n.sp., p. 567
  **maai* n.sp., p. 569
  dubia (Rudow), p. 563
  megastigma (Speiser), p. 564
  **traubi* n.sp., p. 565

Paradyschiria Speiser, p. 571
  fusca Speiser, p. 573
  **lineata* Kessel, p. 574
  parvula Falcoz, p. 574
  **parvuloides* n.sp., p. 575

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Trichobius Gervais
 longipes group, p. 465
  **bequaerti* n.sp., p. 471
  **costalimai* Guimarães, p. 471
  **dunni* n.sp., p. 474
  **dybasi* n.sp., p. 469
  **longipes* (Rudow), p. 465
   (= *mixtus* Curran)
  **mendezi* n.sp., p. 469

 dugesii group, p. 476
  diphyllae n.sp., p. 492
  **dugesii* Townsend, p. 478
  **dugesioides* n.sp., p. 488
  furmani n.sp., p. 490
  **joblingi* n.sp., p. 481
  **macrophylli* n.sp., p. 486
  **parasiticus* Gervais, p. 494
  **urodermae* n.sp., p. 476

Trichobiodes n.g., p. 510
  **perspicillatus* (Pessôa & Galvão), p. 511

Mastoptera n.g., p. 512
  **guimaraesi* n.sp., p. 514
  **minuta* (Costa Lima), p. 515

Exastinion (Pessôa & Guimarães), p. 558
  **clovisi* (Pessôa & Guimarães), p. 558

Aspidoptera Coquillet, p. 551
  **busckii* Coquillet, p. 555
  **delatorrei* n.sp., p. 557
  phyllostomatis (Perty), p. 553

Pseudostrebla Costa Lima, p. 582
  **greenwelli* n.sp., p. 582
  **ribeiroi* Costa Lima, p. 582

?**Stizostrebla** Jobling, p. 586
  longirostris Jobling, p. 586

Eldunnia Curran, p. 586
  **breviceps* Curran, p. 588

SERIES 4 (STREBLINAE). Head with a complete ventral ctenidium. *Male.*—Accessory gonapophyseal setae inserted posterior to the macrosetae. *Female.*—Cerci free; postgenital sclerite usually absent.

Strebla Wiedemann, p. 591
  **altmani* n.sp., p. 623
  **alvarezi* n.sp., p. 625
  **carolliae* n.sp., p. 619
  **christinae* n.sp., p. 606
  consocius n.sp., p. 600
  **diaemi* n.sp., p. 599
  diphyllae n.sp., p. 613
  **galindoi* n.sp., p. 604
  **hertigi* n.sp., p. 596
  **hoogstraali* n.sp., p. 603
  **kohlsi* n.sp., p. 618
  machadoi n.sp., p. 607
  mexicana Rondani, p. 610
  **mirabilis* (Waterhouse), p. 615
  tonatiae (Kessel), p. 602
  **vespertilionis* (Fabricius), p. 609

Paraeuctenodes Pessôa & Guimarães, p. 627
  longipes Pessôa & Guimarães, p. 627

Anastrebla n.g., p. 627
 (= *Strebla* of authors, not Wiedemann, 1824)
  **mattadeni* n.sp., p. 631
  **modestini* n.sp., p. 629
  **nycteridis* n.sp., p. 629

Metelasmus Coquillet, p. 634
  **pseudopterus* Coquillet, p. 634

The species arrangement is alphabetical. The page on which treated or cited is given for each genus and species. The year of publication is added for species not cited in the text.

major group, especially *T. truncatus*. The male of *Parastrebla* is unknown.

The genital apparatus of *Paradyschiria* and *Noctiliostrebla* appears to be less specialized than in the other Trichobiinae, though it may have undergone simplification. Until they can be studied in greater detail, these two genera are placed in Series 3 with some reservations.

In female genital structure (see pp. 519, 549), *Speiseria* is clearly related to the *Trichobius phyllostomae* group and related genera (Series 1). However, it differs from them in the arrangement of the paired (male) gonapophyseal setae. It can hardly be regarded as related to the *Trichobius uniformis* group, with which it is placed here. The disposition of its gonapophyseal setae may have evolved independently of other groups that have the same arrangement.

Because the Streblidae exhibit a high degree of host-limitation and specificity, the groups of Streblidae proposed above, should, if they have any validity, show some concordance with the host taxa. A number of them do, as will be shown below. In figures 142–146, characteristic host associations were used.

Division I. NYCTEROPHILIINAE

Of seven species (four described) of *Nycterophilia,* five occur on Chilonycterinae and Natalidae (fig. 142).[14] An undescribed species, closely related to one that occurs on *Mormoops* (Chilonycterinae) has been taken from *Platalina* (Glossophaginae). *N. coxata* occurs on *Macrotus* (Phyllostominae), as does a related undescribed species from the West Indies. All the hosts of *Nycterophilia* are primarily cave inhabitants. This would facilitate transfer of these flies, both on a temporary and an evolutionary basis, from Chilonycterinae and Natalidae to other cave-inhabiting bats, such as *Leptonycteris* and *Macrotus.*

Division II. TRICHOBIINAE and STREBLINAE

Series 1. Two species (one undescribed) of the *Trichobius pallidus* group (fig. 142) occur on bats of the family Furipteridae. The species of the *caecus* group are closely related to them but differ in being somewhat more specialized. Their eyes are reduced to a single facet, the median thoracic suture is reduced to a short fork, and the first tarsomere possesses a specialized comb scale. There are several undescribed species from *Natalus* and *Pteronotus* but these have not been studied in enough detail to include in the figure.

The host distributions of these groups of *Trichobius* and of *Nycterophilia* support the view of Dalquest and Werner (1954) and de la Torre (1962) that the Chilonycterinae should be regarded as a separate family of

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[14] The dendrogram of presumed relationships of the families and subfamilies of New World Chiroptera in figures 142, 143, and 145, is based in part upon a sketch provided by Dr. Karl Koopman. We have inserted the Emballonuridae and Vespertilionidae, not included by Dr. Koopman and have changed the position of the Desmodidae.

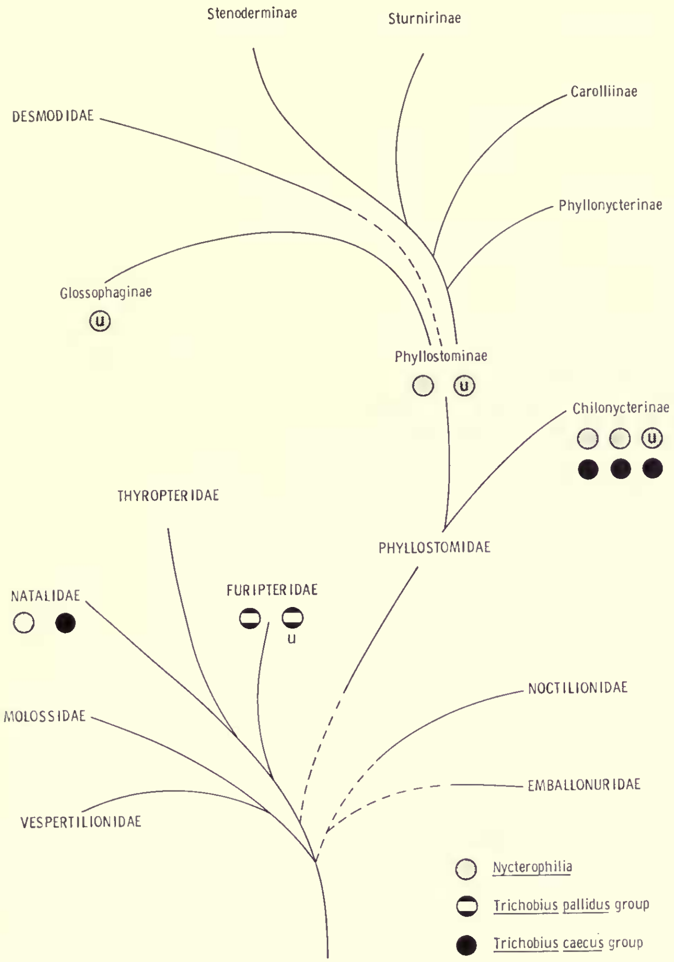

Fig. 142. Dendrogram of families and subfamilies of New World bats, showing host distribution of the species of *Nycterophilia* and of the *Trichobius pallidus* and *caecus* groups. Unless otherwise indicated each symbol represents a separate species. (u = undescribed species.

Vespertilionoidea rather than as a subfamily of Phyllostomidae. On the basis of facial histology (the presence of certain glands), Dalquest and Werner (op. cit.) placed them nearer the Vespertilionidae than to the Furipteridae and Natalidae. De la Torre (unpub. thesis) states that "In skull structure and general morphology the chilonycterid group appears to be much closer to the family Natalidae and to other related genera (*Furipterus*, *Amorphochilus*, and *Thyroptera*) than to the phyllostomid group." This view is more consonant with the streblid distribution than is that of Dalquest and Werner.

The *Trichobius major* group, and the related brachypterous genera

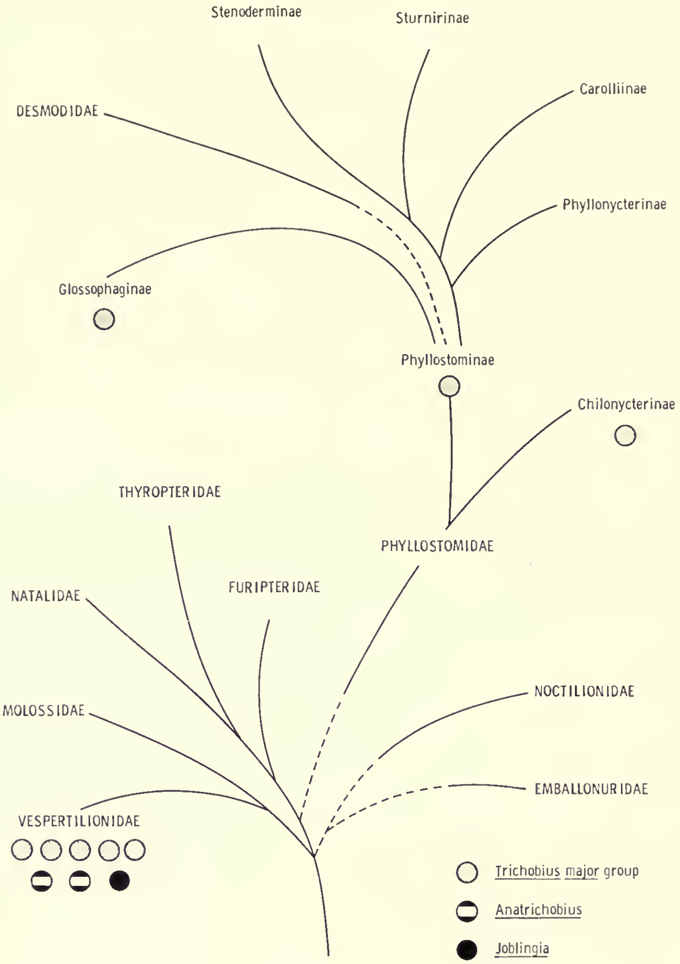

Fig. 143. Dendrogram of families and subfamilies of New World bats, showing host distribution of the species of the *Trichobius major* group and of the derived genera, *Joblingia* and *Anatrichobius* (Series 1). Each symbol represents a separate species.

Joblingia and *Anatrichobius* (fig. 143), occur primarily on cave-dwelling Vespertilionidae, with the exception of a few more specialized forms which occur on other cave bats. These include *T. sparsus* on *Pteronotus parnellii* (Chilonycterinae) and *T. sphaeronotus* on *Leptonycteris nivalis* (Glossophaginae). *Trichobius adamsi* on *Macrotus* (Phyllostominae), is doubtfully included in this group. The species with the most generalized female genital structure are primarily warm temperate North American and subtropical in distribution, either latitudinally or altitudinally. *Joblingia* has been taken only at altitudes above 5500 feet in Panama, Costa Rica, and Guatemala. *Anatrichobius* has been taken at similar elevations in tropical South America and at lower elevations in the southern latitudes.

The Streblidae treated thus far appear to be the most generalized in genital and abdominal structure of all the New World Streblidae. It is interesting to note that they occur chiefly on Vespertilionoidea, which, like the Emballonuroidea, are generally regarded as among the most generalized Microchiroptera. Further, these flies occur chiefly on cave bats. It has been suggested (Jobling, 1949b; Theodor, 1957) in regard to the origin of batflies, that they evolved from guano-inhabiting flies of caves. Few New World Streblidae occur on Emballonuroidea, with the exception of *Paradyschiria* and *Noctiliostrebla* on the Noctilionidae, and several species on Emballonuridae. This is probably because most New World Emballonuridae roost in very small numbers, in exposed situations. Those on the Emballonuridae are related to forms that occur on Phyllostomidae, and at least one host (see p. 627), shares a species with ecologically associated phyllostomine bats.

The *Trichobius phyllostomae* group and the presumably derived genera, are also placed in Series 1, but do not appear to be closely related to the other streblids of that series. All of the described species [15] occur on genera that de la Torre (op. cit.) places as two compact and related groups of Stenoderminae (fig. 144).[16] Their host distribution not only indicates that these Streblidae are closely related and have primarily radiated on the Stenoderminae, but also supports de la Torre's grouping of these hosts.

Of special interest is the distribution of the four species of the *Trichobius phyllostomae* group on *Sturnira, Vampyrops,* and *Artibeus,* and similarly, of the *Megistopoda* species on *Sturnira* and *Artibeus. Aspidoptera,* which belongs to Series 3, is similarly restricted to *Sturnira, Artibeus* (*lituratus* and *jamaicensis*) and possibly *Chiroderma.* Since *Sturnira* apparently does not roost with these bats, though they have been observed feeding with them (de la Torre, pers. comm.), the parallel occurrence of closely related species of three genera of Streblidae on bats of the genera *Sturnira* and *Artibeus,* and of a species of one of these genera on *Vampyrops,* gives credence to de la Torre's contention (op. cit.) that the Sturnirinae should be placed with the Stenoderminae and not retained as a separate subfamily.

Series 2. The species of the *uniformis* group are very closely related. Three of the four occur on three genera of Glossophaginae (fig. 144), respectively, and the fourth (*keenani*) on species of *Micronycteris.* In Panama, *Micronycteris megalotis,* one of the hosts of *keenani,* was frequently found roosting with *Glossophaga soricina,* and it is possible that such an ecological association may, historically, explain this distribution of the flies.

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[15] An undescribed species of *Paratrichobius* has been taken from *Choeronycteris mexicana* in Arizona.

[16] Dr. de la Torre has added several genera which he inadvertently omitted from his dendrogram, which appeared as fig. 4 in his unpublished thesis (1961), and has kindly given us permission to reproduce it. We have used the same dendrogram, with modifications, in fig. 146.

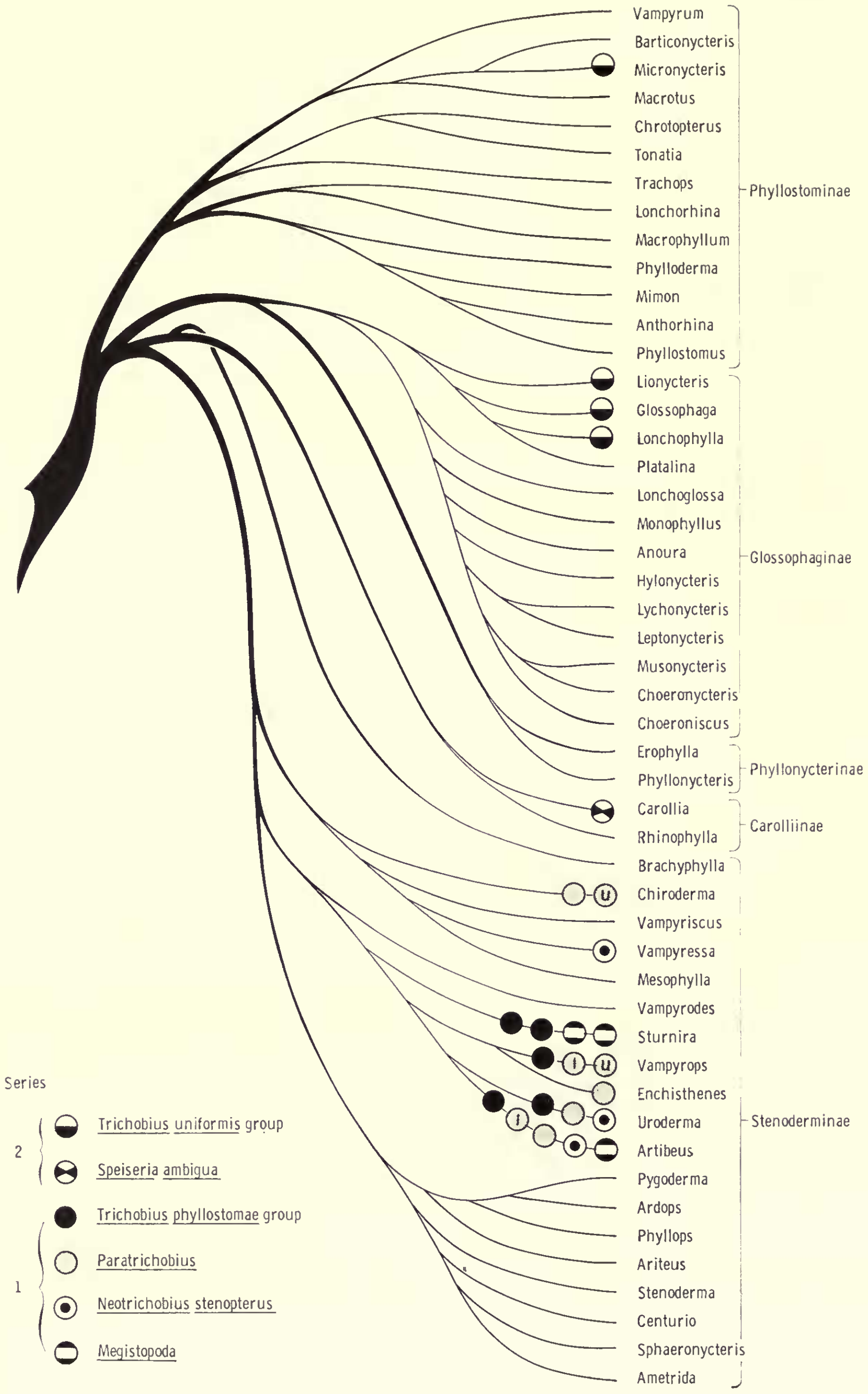

Fig. 144. Dendrogram of relationships of genera of phyllostomid bats, showing host associations of Streblidae of the *Trichobius phyllostomae* group and related genera, and of the *T. uniformis* group. (l = *longicrus* group. u = undescribed species.)

It should be noted that the three host genera of Glossophaginae belong to a cluster of genera that de la Torre considers to be closely related. The Streblidae on other genera of Glossophaginae are not at all closely related to the *uniformis* group.

The genus *Speiseria* cannot be placed satisfactorily with either the *uniformis* group or the *phyllostomae* group and related genera, though it seems to be more closely related to the last-named. It is placed in Series 2, with the *uniformis* group, because of the arrangement of its accessory gonapophyseal setae. In all of its other characters, including the presence of a female postgenital sclerite, it is closer to the *phyllostomae* group and related genera. Although it appears to be primarily a parasite of species of *Carollia*, we have seen several collections taken from *Vampyrops vittatus*, one from Panama, the others from Guatemala. Interestingly, the problem of the relationships of *Speiseria* is much the same as that of the relationship of its principal hosts, the Carolliinae.

Series 3. It should be noted again that the Streblidae of Series 1 and 2—in which the female cerci are articulated or fused with the ventral arc—are largely restricted to or are characteristic parasites of non-phyllostomine bats. On the other hand, most of the genera of Series 3 are characteristic parasites of Phyllostominae, with the exception of *Aspidoptera* on Stenoderminae, *Noctiliostrebla* and *Paradyschiria* on Noctilionidae, and some species of the *Trichobius longipes* and *dugesii* groups. The two latter groups have scattered representatives on a miscellaneous assortment of hosts, probably derived through ecological association. These hosts include Molossidae, Stenoderminae, Glossophaginae, Carolliinae, and Desmodidae, but apparently no Vespertilionoidea or Emballonuroidea.

The distribution of the *longipes* and *dugesii* groups is shown in fig. 145. Several undescribed species are included. With the exception of *T. dunni* and two other closely related (undescribed) species from Molossidae, the members of the *Trichobius longipes* group (p. 465) are restricted to *Phyllostomus* and *Tonatia*, as are the species of *Mastoptera*. These are generally regarded as closely related genera of bats, along with *Mimon*. No Streblidae, only Nycteribiidae, are known from *Mimon*. None are known from the genus *Vampyrum*, either.

In the *dugesii* group, the species of the *dugesii* complex (p. 476) are found on *Macrophyllum* (Phyllostominae), *Glossophaga* (Glossophaginae) *Carollia* (Carolliinae), and *Uroderma* (Stenoderminae). Three undescribed species are known to us from *Anoura* and *Choeronycteris* (Glossophaginae) and *Artibeus* (Stenoderminae). Their close relationship with species of the *Trichobius longipes* group suggests that they are derived from them and have secondarily radiated onto both phylogenetically and ecologically related bats. Of the species in the *parasiticus* complex (p. 487), *T. dugesioides* occurs on Phyllostominae (*Trachops*) and Carolliinae (probably secondarily, on *Carollia*), while three others, including an undescribed species from *Diaemus*, are parasites of Desmodidae. A fifth species, *furmani*, has also been taken on Desmodidae and on *Glossophaga* (Glossopha-

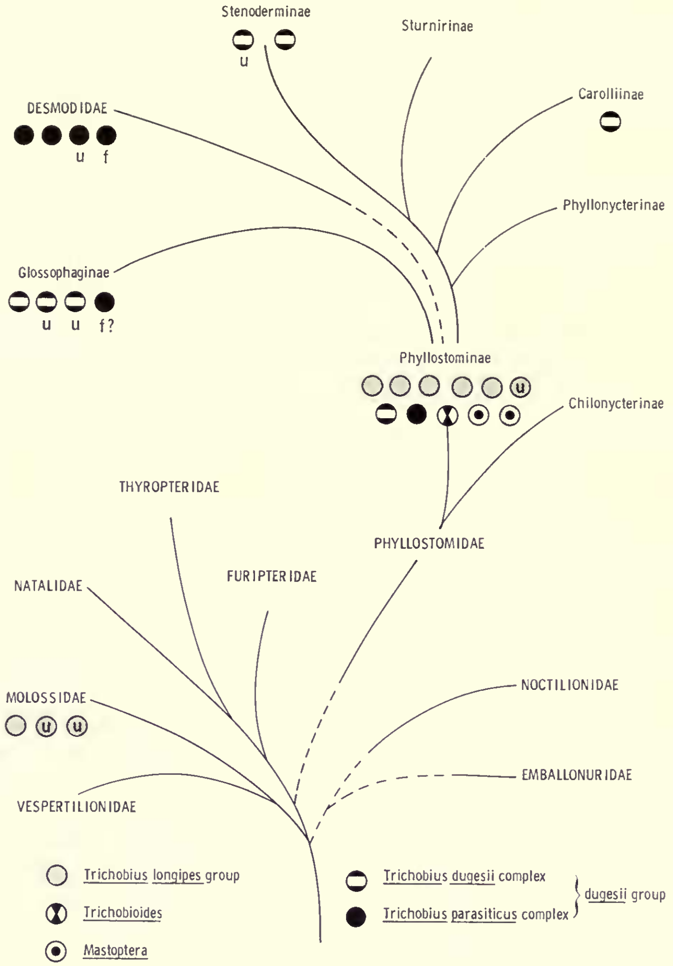

Fig. 145. Dendrogram of families and subfamilies of New World bats, showing host distribution of the species of the *Trichobius longipes* and *dugesii* groups. Unless otherwise indicated, each symbol represents a separate species. (u = undescribed species. f = *T. furmani* new species. ? = host association not confirmed.)

ginae), but its characteristic host has not been ascertained. It is apparent that members of this complex have evolved from parasites of Phyllostominae and some have radiated on the Desmodidae, along with the hosts. The three characteristic species of *Desmodus, Diphylla,* and *Diaemus* are more closely related to each other than to other members of the complex. The most specialized of these three, *T. parasiticus,* parasitizes *Desmodus.*

Series 4. The distribution of genera and species of Streblinae is shown in figure 146. In tibial chaetotaxy and structure of the head, the genus *Strebla* appears to be the most generalized. Most of the species of *Strebla* may be assigned to one of two groups. In the species of one, the frontoclypeus is complete; in the others, it has detached apical plates. Which of these is the generalized condition is not known, though it would seem reasonable to assume that the detached plates are a derived condition. All other Streblidae, including the generalized forms, have a complete frontoclypeus. One species, *S. galindoi,* is intermediate in structure. It is possible that detached plates may have appeared independently more than once, and that their presence may depend to some extent upon the relative length of the head and the mobility of the anterior area. Four of the five species that have a complete frontoclypeus occur on *Phyllostomus* and *Tonatia,* the fifth on *Diaemus. S. galindoi,* the species with the intermediate condition, occurs on *Tonatia.* Of the species with detached frontoclypeal plates, five occur on *Phyllostomus, Trachops,* and *Tonatia;* one on both *Micronycteris* and *Saccopteryx;* two on Desmodidae; and one on Carolliinae. Three additional undescribed species are known to us, two of them from Emballonuridae (*Saccopteryx* and *Cormura*). These emballonurids appear to be ecologically closely associated with *Micronycteris* (see p. 627), and it seems likely that these species of *Strebla* have moved onto Emballonuridae secondarily. The principal evolution of the genus seems to have been on Phyllostominae, with secondary radiation on the Carolliinae, Desmodidae and possibly Emballonuridae. *Strebla altmani* (on *Lonchorhina* and *Macrophyllum*), *alvarezi* (on *Micronycteris* and *Saccopteryx*), *kohlsi* (on *Tonatia*), *mirabilis* (on *Phyllostomus* and *Trachops*), and *carolliae* (on *Carollia*) appear to be closely related.

The genus *Paraeuctenodes* is known from too few specimens for one to assess host relationships. The only described species, *P. longipes,* was taken from *Lonchoglossa caudifera* (Glossophaginae). We have seen a few specimens of two undescribed species (see p. 627) taken from *Carollia perspicillata,* but this may not be a normal host. In their tibial characters, the species of *Paraeuctenodes* resemble *Strebla* and *Metelasmus,* but unlike them, they lack a remiform postgenal seta.

The three known species of *Anastrebla* occur on *Anoura* (Glossophaginae). An unidentified species has been taken from *Lonchoglossa caudifera* (Speiser, 1900; Kessel, 1924, 1925). The genus *Metelasmus,* which like *Anastrebla* and *Paraeuctenodes* appears to be derived from forms related to *Strebla,* occurs primarily on *Artibeus* but has also been taken from *Enchisthenes* and *Sturnira.*

The Streblidae of the Desmodidae are interesting. The species of *Trichobius* that occur on them—*parasiticus* (on *Desmodus*), *diphyllae* (on *Diphylla*), and an undescribed species (from *Diaemus*)—are very closely related. *T. furmani,* which occurs on *Desmodus* (and apparently other hosts as well), and *T. dugesioides,* a parasite of *Trachops* (and probably secondarily of *Carollia*) belong to this species complex also. Two of the *Strebla* species, *diphyllae* (on *Diphylla*) and *vespertilionis* (on *Desmodus*) are very closely related to species from Phyllostominae. While the third species, *diaemi,* belongs to a different group, it, too, is related to forms (*consocius* and *hertigi*) that occur on the genus *Phyllostomus.* If the streblid fauna of these bats is of any significance in indicating the relationships of the Desmodidae, it would appear that the Desmodidae are derived from

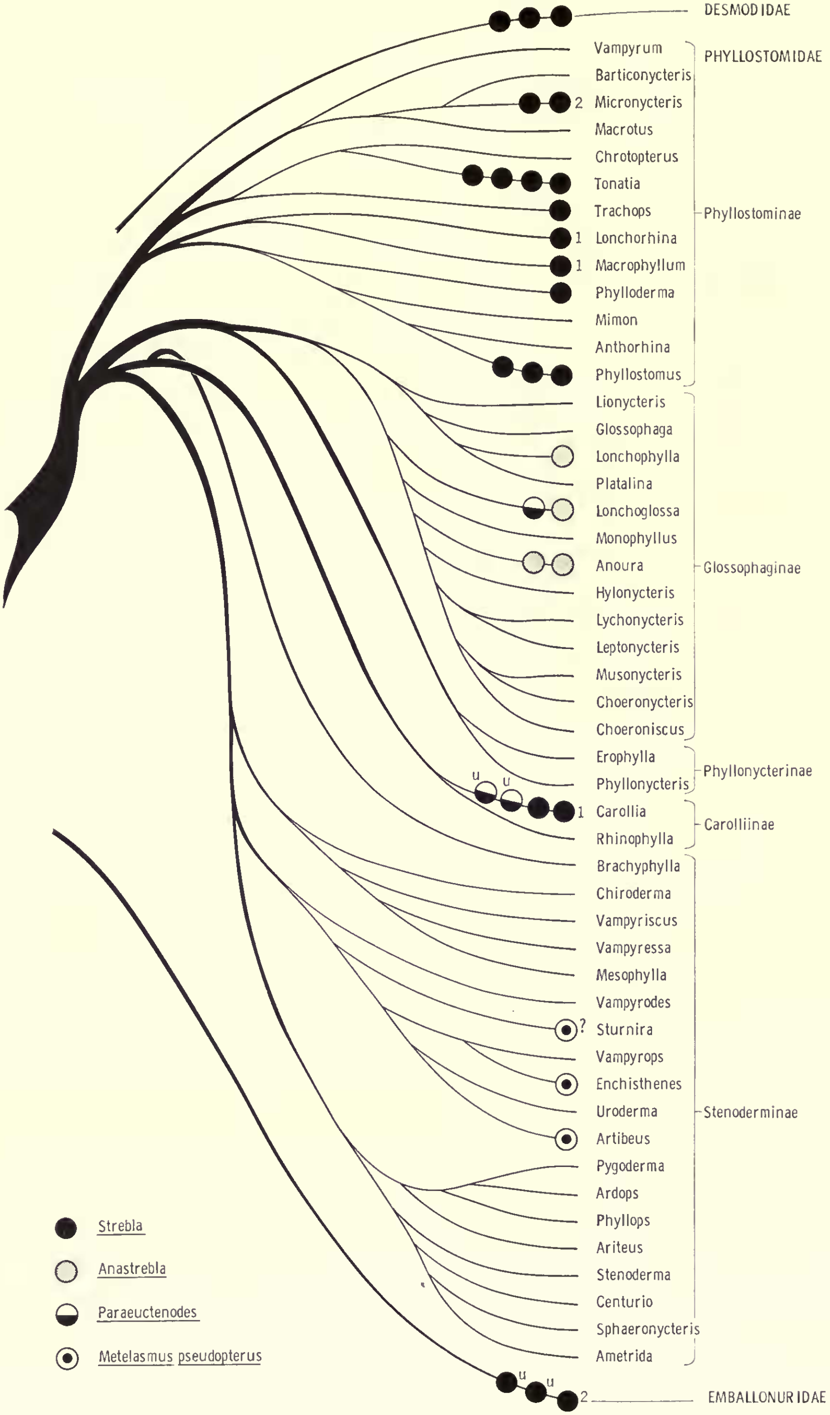

Fig. 146. Hosts of genera and species of Streblinae. *Strebla mirabilis* is shown on both *Trachops* and *Phyllostomus*. u = undescribed. 1 = *S. altmani*. 2 = *S. alvarezi*. Other symbols represent separate species.

Phyllostominae. One might even venture the guess that the ancestral forms were carnivorous or omnivorous species related to *Trachops, Chrotopterus* or *Phyllostomus.*

In our treatment of the Streblidae of Panama we have in several instances discussed data that bear on the taxonomy of the hosts. These are summarized below, and a few other comments are added.

1. The host distribution (fig. 142) of the Nycterophiliinae and of the *Trichobius caecus* (p. 448) and *pallidus* (p. 447) groups support the contention (see p. 652) that the Chilonycterinae do not belong in the Phyllostomidae, but are a separate family of Vespertilionoidea, related to the Natalidae (especially) and the Furipteridae.

2. The host distribution of the *uniformis* group (pp. 459, 655, fig. 144) suggests that the glossophagine genera on which they occur form a natural group. The Streblidae found on the other genera of Glossophaginae exhibit little concordance with the host classification.

3. The Streblidae of Carolliinae are of little help in resolving the relationships of these hosts. *Speiseria ambigua* appears to be more closely related to the parasites of Stenoderminae than to any others, but *Strebla carolliae* and *Trichobius joblingi* are most closely related to parasites of Phyllostominae.

4. The relationships of the Streblidae that occur on Desmodidae suggest that the vampire bats evolved from Phyllostomine bats related to *Trachops, Chrotopterus* or *Phyllostomus* (see p. 659).

5. The streblid faunules of *Phyllostomus hastatus panamensis* and *P. h. hastatus* have only one species of streblid, *Trichobius longipes,* in common. It is suggested that these bats may be distinct species.

6. Similarly, speciation in the streblid genera *Noctiliostrebla* (see p. 562) and *Paradyschiria* suggests that at least some of the subspecies of the host bat, *Noctilio leporinus,* and possibly *N. labialis,* may be distinct species. The parasites should prove valuable in segregating and defining some of the "subspecies" of these hosts.

7. The different Streblidae on *Diphylla ecaudata* in parts of the range of that host, suggest that this bat may not be monotypic (see p. 615).

8. The taxonomic relationships and host associations of their Streblidae, support de la Torre's contention (unpub. thesis, 1961; 1962) that the Sturnirinae should not be treated as a separate subfamily but should be placed with the Stenoderminae. They also support de la Torre's (1961) groupings of genera (fig. 144) within the Stenoderminae.

Abstract

Although primarily concerned with Panama, this study is a preliminary review of the genera and species of New World batflies of the family Streblidae (excluding eight described Nearctic and West Indian and two South American species). Morphology, classification, collecting and study techniques are treated. Twenty-three genera (seven new) and 87 species (50 new) are treated and/or keyed and figured, bringing the total number of described species to 94. Of these, 20 genera and 66 species (44 new) are recorded from Panama. Two genera (one new) and 22 species (20 new) are known only from Panama.

Host and distribution records and biological notes are given. Host-parasite relation-

ships are discussed. Study of more than 12,000 Panamanian Streblidae from more than 50 host species indicates that, contrary to previously held opinion, the New World species are highly host-specific in the lowland tropics, the center of their distribution. In Panama, about 55 percent of the species are known from a single host; another 15 percent are clearly monoxenous, though they may occasionally occur as strays on ecologically associated hosts; and about 13.5 percent of the remaining species are restricted to bats of a single genus. Only about 15 percent of the total normally occur on bats of more than one genus. These are usually bats of the same family or of closely related genera of the same sub-family, though in some instances they are ecologically rather than phylogenetically related genera. It is suggested that more detailed investigations, such as cyto-taxonomic and behavioral studies, may show that some of the species which normally appear to occur on more than one host may prove to be complexes of cryptic species.

Most of the Streblidae on fruit bats (Phyllostomidae: Sturnirinae and Stenoderminae) are closely related and appear to have radiated on these bats. The Streblidae of *Sturnira* are very closely related to those of the Stenoderminae, especially *Artibeus*, and support the view that the Sturnirinae should be included in the Stenoderminae. The Streblidae of the Chilonycterinae (Phyllostomidae), Furipteridae, and Natalidae are closely related and support the view that the Chilonycterinae should be regarded as a distinct family related to the Furipteridae and Natalidae. The streblid faunules of *Phyllostomus hastatus* and of the Noctilionidae suggest that some of the subspecies of these bats may actually be distinct species. Monotypic hosts appear to rarely, if ever, have different Streblidae in different parts of their geographic ranges. Where such appears to be the case, it is suggested that cryptic host taxa may be involved. However, the ranges of host and parasite need not be coterminous.

In only a few instances do Streblidae of the same genus occur together on the same host. In one such case, there is a suggestion of competition between species of *Strebla* on the bat *Phyllostomus hastatus*. In most other instances of synoxenous Streblidae, the flies appear to be morphologically adapted to different micro-habitats on the hosts.

NEW TAXA.—*Anastrebla* n. gen., *modestini* (type-species), *mattadeni*, *nycteridis*, n. spp.; *Anatrichobius* n. gen., *scorzai* n. sp. (type-species); *Aspidoptera delatorrei* n. sp.; *Exastinion* n. gen. (type-species: *Aspidoptera clovisi* Pessôa & Guimarães, 1936); *Mastoptera* n. gen. (type-species: *Aspidoptera minuta* Costa Lima, 1921), *guimaraesi* n. sp.; *Megistopoda theodori* n. sp.; *Noctiliostrebla* n. gen. (type-species: *Lipoptena dubia* Rudow, 1870), *aitkeni*, *maai*, *traubi*, n. spp.; Nycterophiliinae, new subfam. for *Nycterophilia* Ferris; *Nycterophilia fairchildi*, *parnelli*, *natali*, n. spp.; *Paradyschiria parvuloides* n. sp.; *Parastrebla* n. gen., *handleyi* n. sp. (type-species); *Paratrichobius lowei*, *sanchezi*, *salvini*, n. spp.; *Pseudostrebla greenwelli* n. sp.; *Strebla altmani*, *alvarezi*, *carolliae*, *christinae*, *consocius*, *diaemi*, *diphyllae*, *galindoi*, *hertigi*, *hoogstraali*, *kohlsi*, *machadoi*, n. spp.; *Trichobioides* n. gen. (type-species: *Trichobius perspicillatus* Pessôa & Galvão, 1937); *Trichobius bequaerti*, *brennani*, *diphyllae*, *dugesioides*, *dunni*, *dybasi*, *furmani*, *galei*, *joblingi*, *johnsonae*, *keenani*, *lionycteridis*, *lonchophyllae*, *macrophylli*, *mendezi*, *urodermae*, *vampyropis*, *yunkeri*, n. spp.; *Neotrichobius* n. gen., *stenopterus* n. sp. (type-species).

NEW SYNONYMY.—*Strebla longipes* Rudow, 1870 (=*Trichobius mixtus* Curran, 1935). *Strebla* Wiedemann, 1824 (=*Euctenodes* Waterhouse, 1879). SPECIES REMOVED FROM SYNONYMY.—*Paradyschiria fusca* Speiser (1900), *lineata* Kessel (1925), and *parvula* Falcoz (1931) not synonyms of, nor congeneric with *Lipoptena dubia* Rudow (1870). *Aspidoptera busckii* Coquillet, 1899, not a synonym of *Li. phyllostomatis* Perty, 1833.

CHANGES IN ASSIGNMENT.—*Lipoptena dubia* Rudow, 1870, made type-species of *Noctiliostrebla* n. gen. *Aspidoptera clovisi* Pessôa & Guimarães, 1936, made type-species of *Exastinion* n. gen. *Aspidoptera minuta* Costa Lima, 1921, made type-species of *Mastoptera* n. gen. *Lepopteryx megastigma* Speiser, 1900, transferred to *Noctiliostrebla* n. gen. *Trichobius perspicillatus* Pessôa & Galvão, 1937, made type-species of *Trichobioides* n. gen. *Pseudostrebla* Costa Lima, 1921, *Stizostrebla* Jobling, 1939, and *Eldunnia* Curran, 1934, removed from the subfamily Streblinae and assigned to the Trichobiinae.

HOST-PARASITE LIST

The following list includes all host-parasite records of Streblidae that are included in this paper. All names preceded by a dagger (†) are of records from outside Panama. When a host name is preceded by a dagger, this applies to all of the streblids listed as well. Streblid names preceded by an asterisk (*) indicate that the host bat is probably not a normal host for the fly and that the record probably represents a transitory or accidental association (contamination) or may be in error.

For the sake of uniformity, we have followed Handley's treatment (see Checklist of Mammals) of the Chilonycterinae and Sturnirinae.

Class MAMMALIA
Order CHIROPTERA
Superfamily Emballonuroidea
Family Emballonuridae

Saccopteryx bilineata
Strebla alvarezi n.sp.
* ″ *vespertilionis* (Fabricius)

Family Noctilionidae

†Noctilio labialis subsp.
Paradyschiria parvula Falcoz
″ *parvuloides* n.sp.

†Noctilio labialis albiventer
(=*Dirias albiventer*)
Paradyschiria parvula Falcoz

Noctilio labialis labialis
†*Noctiliostrebla aitkeni* n.sp.
″ *maai* n.sp.
Paradyschiria parvuloides n.sp.

"Dirias" sp.
(=*N. labialis*)
**Trichobius joblingi* n.sp.

†Noctilio dorsatus
(=*Noctilio leporinus*)
Noctiliostrebla dubia (Rudow)
″ *megastigma* (Speiser)

Noctilio leporinus
Noctiliostrebla traubi n.sp.
Paradyschiria fusca Speiser

†Noctilio leporinus leporinus
Noctiliostrebla aitkeni n.sp.
Paradyschiria fusca Speiser

†Noctilio leporinus mastivus
Noctiliostrebla traubi n.sp.
Paradyschiria lineata Kessel

Noctilio leporinus mexicanus
**Neotrichobius stenopterus* n.g., n.sp.
Noctiliostrebla traubi n.sp.
Paradyschiria lineata Kessel

Superfamily Phyllostomoidea
Family Phyllostomidae
Subfamily Chilonycterinae

Pteronotus parnellii fuscus
(=*Chilonycteris rubiginosa fusca*)
Nycterophilia parnelli n.sp.
**Speiseria ambigua* Kessel
**Strebla altmani* n.sp.
* ″ *carolliae* n.sp.
Trichobius sparsus Kessel
″ *yunkeri* n.sp.
* ″ *joblingi* n.sp.
* ″ *costalimai* Guimarães

Pteronotus psilotis
Nycterophilia fairchildi n.sp.
Trichobius johnsonae n.sp.

Pteronotus suapurensis
Nycterophilia fairchildi n.sp.
Trichobius johnsonae n.sp.
″ *yunkeri* n.sp.

Subfamily Phyllostominae

Micronycteris megalotis microtis
Strebla alvarezi n.sp.
**Trichobius joblingi* n.sp.
″ *keenani* n.sp.

Micronycteris minuta
†*Strebla machadoi* n.sp.
**Trichobius dugesioides* n.sp.

Micronycteris nicefori
Parastrebla handleyi n.g., n.sp.
Strebla alvarezi n.sp.
**Trichobius joblingi* n.sp.
″ *keenani* n.sp.

†Micronycteris brachyotis
(=*M.* [*Lampronycteris*] *platyceps*)
**Trichobius joblingi* n.sp.

Micronycteris sylvestris
Strebla alvarezi n.sp.

- **Lonchorhina a. aurita**
  - **Speiseria ambigua* Kessel
  - *Strebla altmani* n.sp.
  - * ″ *carolliae* n.sp.
  - **Trichobius dugesioides* n.sp.
  - ″ *joblingi* n.sp.
  - * ″ *macrophylli* n.sp.
  - * ″ *yunkeri* n.sp.
- **Macrophyllum macrophyllum**
  - *Strebla altmani* n.sp.
  - * ″ *carolliae* n.sp.
  - **Trichobius joblingi* n.sp.
  - ″ *macrophylli* n.sp.
- **Tonatia bidens**
  - *Strebla galindoi* n.sp.
  - † ″ sp. (? *mirabilis*)
  - *Trichobius bequaerti* n.sp.
- **†Tonatia brasiliensis**
  - *Strebla tonatiae* (Kessel)
- **Tonatia minuta**
  - *Mastoptera minuta* (Costa Lima)
  - *Pseudostrebla greenwelli* n.sp.
  - *Strebla hoogstraali* n.sp.
  - *Trichobius mendezi* n.sp.
- **Tonatia s. silvicola** (=*T. amblyotis*)
  - *Mastoptera minuta* (Costa Lima)
  - *Pseudostrebla ribeiroi* (Costa Lima)
  - *Strebla kohlsi* n.sp.
  - *Trichobius dybasi* n.sp.
- **Tonatia sp. (? silvicola)**
  - †*Stizostrebla longirostris* Jobling
- **Tonatia sp. (?)**
  - *Strebla galindoi* n.sp.
  - **Trichobius dugesioides* n.sp.
- **Phyllostomus d. discolor**
  - **Aspidoptera busckii* Coquillet
  - **Megistopoda aranea* (Coquillet)
  - *Strebla hertigi* n.sp.
  - * ″ *mirabilis* (Waterhouse)
  - *Trichobioides perspicillatus* (Pessôa & Galvão)
  - *Trichobius costalimai* Guimarães
  - † ″ *longipes* (Rudow)
- **†Phyllostomus d. verrucosus**
  - *Strebla hertigi* n.sp.
  - *Trichobioides perspicillatus* (Pessôa & Galvão)
  - *Trichobius costalimai* Guimarães
- **†Phyllostomus discolor** subsp.
  - **Strebla vespertilionis* (Fabricius)
- **†Phyllostomus elongatus**
  - *Trichobioides perspicillatus* (Pessôa & Galvão)
  - *Trichobius costalimai* Guimarães
- **†Phyllostomus h. hastatus**
  - **Neotrichobius stenopterus* n.g., n.sp.
  - *Strebla consocius* n.sp.
  - **Trichobius joblingi* n.sp.
  - ″ *longipes* (Rudow)
- **Phyllostomus h. panamensis**
  - *Mastoptera guimaraesi* n.sp.
  - * ″ *minuta* (Costa Lima)
  - **Speiseria ambigua* Kessel
  - **Strebla carolliae* n.sp.
  - ″ *hertigi* n.sp.
  - ″ *mirabilis* (Waterhouse)
  - **Trichobius joblingi* n.sp.
  - ″ *longipes* (Rudow)
  - * ″ *parasiticus* Gervais
  - * ″ *yunkeri* n.sp.
- **Phyllostomus hastatus** subsp.
  - *Strebla consocius* n.sp.
- **Phyllostomus** sp.
  - **Aspidoptera phyllostomatis* (Perty)
  - *Mastoptera guimaraesi* n.sp.
  - †**Megistopoda* sp.
  - *Trichobius longipes* (Rudow)
  - †* ″ *phyllostomae* Kessel
- **From a mixed collection of Phyllostomus and Pteronotus spp.**
  - *Trichobius longipes* (Rudow)
- **Phylloderma s. stenops**
  - *Strebla christinae* n.sp.
- **Trachops c. cirrhosus**
  - **Speiseria ambigua* Kessel
  - **Strebla altmani* n.sp.
  - * ″ *carolliae* n.sp.
  - ″ (?) *mirabilis* (Waterhouse)
  - **Trichobius dugesii Townsend*
  - ″ *dugesioides* n.sp.
  - ″ *joblingi* n.sp.
- **†Trachops cirrhosus coffini**
  - **Strebla diphyllae* n.sp.
  - ″ (?) *mirabilis* (Waterhouse)
- **†Trachops** sp.
  - **Strebla consocius* n.sp.
- **Chrotopterus auritus**
  - *Trichobius dugesioides* n.sp.

Subfamily Glossophaginae

- **Glossophaga s. leachii**
  - **Eldunnia breviceps* Curran
  - **Speiseria ambigua* Kessel
  - **Strebla carolliae* n.sp.
  - *Trichobius dugesii* Townsend
  - * ″ *joblingi* n.sp.
  - ″ *uniformis* Curran
- **†Glossophaga s. soricina**
  - *Trichobius furmani* n.sp.

†**Glossophaga s. valens**
Trichobius dugesii Townsend
From a mixed collection of
Glossophaga s. leachii and
Carollia p. azteca
Speiseria ambigua Kessel
Trichobius dugesii Townsend
″ _dugesioides_ n.sp.
″ _joblingi_ n.sp.
Lonchophylla robusta
Anastrebla nycteridis n.sp.
†_Anatrichobius scorzai_ n.g., n.sp.
Eldunnia breviceps Curran
*_Speiseria ambigua_ Kessel
*_Strebla carolliae_ n.sp.
*_Trichobius joblingi_ n.sp.
* ″ _johnsonae_ n.sp.
″ _lonchophyllae_ n.sp.
Lionycteris spurrelli
Trichobius lionycteridis n.sp.
†**Anoura aculeata**
Anastrebla mattadeni n.sp.
Exastinion clovisi (Pessôa & Guimarães)
Anoura cultrata
Anastrebla mattadeni n.sp.
Exastinion clovisi (Pessôa & Guimarães)
†**Anoura g. geoffroyi**
Anastrebla modestini n.sp.
Exastinion clovisi (Pessôa & Guimarães)
Anoura g. lasiopyga
*_Anastrebla mattadeni_ n.sp.
″ _modestini_ n.sp.
Exastinion clovisi (Pessôa & Guimarães)

Subfamily Carolliinae

Carollia castanea
Speiseria ambigua Kessel
Strebla carolliae n.sp.
Trichobius joblingi n.sp.
Carollia p. azteca
*_Aspidoptera busckii_ Coquillet
* ″ _delatorrei_ n.sp.
*_Mastoptera guimaraesi_ n.sp.
*_Megistopoda aranea_ (Coquillet)
*_Metelasmus pseudopterus_ Coquillet
*_Nycterophilia parnelli_ n.sp.
†?_Paraeuctenodes_ sp.
*_Paratrichobius dunni_ (Curran)
Speiseria ambigua Kessel
Strebla altmani n.sp.
″ _carolliae_ n.sp.
* ″ _mirabilis_ (Waterhouse)
*_Strebla vespertilionis_ (Fabricius)
*_Trichobius costalimai_ Guimarães
* ″ _dugesii_ Townsend
″ _dugesioides_ n.sp.
″ _joblingi_ n.sp.
* ″ _johnsonae_ n.sp.
* ″ _longipes_ (Rudow)
* ″ _macrophylli_ n.sp.
* ″ _sparsus_ Kessel
* ″ _urodermae_ n.sp.
* ″ _yunkeri_ n.sp.
†**Carollia p. perspicillata**
Paraeuctenodes sp.
Strebla carolliae n.sp.
* ″ _consocius_ n.sp.
* ″ _vespertilionis_ (Fabricius)
Trichobius joblingi n.sp.
Carollia subrufa
Speiseria ambigua Kessel
Strebla carolliae n.sp.
Trichobius dugesioides n.sp.
″ _joblingi_ n.sp.
From a mixed collection of
Carollia sp. and
Natalus s. mexicanus
Trichobius dugesioides n.sp.

Subfamily Stenoderminae

Sturnira lilium parvidens
Aspidoptera delatorrei n.sp.
Megistopoda proxima (Séguy)
*_Paradyschiria parvuloides_ n.sp.
*_Trichobioides perspicillatus_ (Pessôa & Galvão)
Sturnira ludovici
Megistopoda theodori n.sp.
Trichobius brennani n.sp.
* ″ _yunkeri_ n.sp.
Sturnira sp.
*_Trichobius costalimai_ Guimarães
† ″ n.sp.
Uroderma bilobatum
?_Neotrichobius stenopterus_ n.g., n.sp.
Paratrichobius dunni (Curran)
*_Trichobius costalimai_ Guimarães
* ″ _joblingi_ n.sp.
* ″ _keenani_ n.sp.
″ _urodermae_ n.sp.
Vampyrops helleri
Paratrichobius sp. B
Vampyrops vittatus
Paratrichobius sp.
Speiseria ambigua Kessel
*_Strebla mirabilis_ (Waterhouse)
Trichobius vampyropis n.sp.

Vampyrodes caraccioli major
**Strebla vespertilionis* (Fabricius)
Vampyressa nymphaea
Aspidoptera busckii Coquillet
Metelasmus pseudopterus Coquillet
Vampyressa pusilla
Neotrichobius stenopterus n.g., n.sp.
Vampyressa sp.
Paratrichobius dunni (Curran)
Chiroderma salvini
Paratrichobius salvini n.sp.
Chiroderma villosum jesupi
Aspidoptera busckii Coquillet
Paratrichobius sp. A
**Trichobius joblingi* n.sp.
Ectophylla macconelli
†*Strebla consocius* n.sp.
Artibeus aztecus
Paratrichobius sp.
Artibeus cinereus
Neotrichobius stenopterus n.g., n.sp.
Paratrichobius lowei n.sp.
†Artibeus j. parvipes
Aspidoptera busckii Coquillet
Artibeus j. jamaicensis
Aspidoptera busckii Coquillet
Megistopoda aranea (Coquillet)
Metelasmus pseudopterus Coquillet
?*Neotrichobius stenopterus* n.g., n.sp.
Paratrichobius sp. (?*longicrus* M. Ribeiro)
**Strebla carolliae* n.sp.
* ″ *hertigi* n.sp.
* ″ *vespertilionis* (Fabricius)
**Trichobius joblingi* n.sp.
* ″ *longipes* (Rudow)
* ″ *uniformis* Curran
†Artibeus "j. lituratus"
Paratrichobius longicrus (M. Ribeiro)
**Strebla carolliae* n.sp.
Trichobius phyllostomae Kessel
Artibeus lituratus palmarum
Aspidoptera busckii Coquillet
Megistopoda aranea (Coquillet)
Metelasmus pseudopterus Coquillet
Paratrichobius longicrus (M. Ribeiro)
**Speiseria ambigua* Kessel
**Trichobius costalimai* Guimarães
* ″ *joblingi* n.sp.
* ″ *lonchophyllae* n.sp.
* ″ *vampyropis* n.sp.
* ″ *yunkeri* n.sp.
Artibeus toltecus
Paratrichobius sp.
Enchisthenes hartii
†**Anastrebla mattadeni* n.sp.
Paratrichobius sanchezi n.sp.
Centurio senex
†**Strebla vespertilionis* (Fabricius)

Family Desmodidae

†Desmodus r. rotundus
Strebla vespertilionis (Fabricius)
Trichobius furmani n.sp.
* ″ *joblingi* n.sp.
″ *parasiticus* Gervais
Desmodus r. murinus
**Megistopoda aranea* (Coquillet)
**Speiseria ambigua* Kessel
†*Strebla diphyllae* n.sp.
* ″ *hertigi* n.sp.
″ *vespertilionis* (Fabricius)
**Trichobius costalimai* Guimarães
* ″ *dugesioides* n.sp.
* ″ *joblingi* n.sp.
″ *parasiticus* Gervais
* ″ *uniformis* Curran
**Trichobioides perspicillatus* (Pessôa & Galvão)
†Diaemus youngii
Trichobius n.sp.
Diaemus y. cypselinus
Strebla diaemi n.sp.
Trichobius parasiticus Gervais
Diphylla ecaudata
†*Trichobius furmani* n.sp.
†Diphylla e. centralis
Strebla diphyllae n.sp.
Trichobius diphyllae n.sp.
″ *parasiticus* Gervais
"Vampire Bats"
Trichobius parasiticus Gervais

Superfamily Vespertilionoidea

Family Furipteridae

Furipterus horrens
†*Trichobius pallidus* (Curran)

Family Natalidae

Natalus stramineus mexicanus
Nycterophilia natali n.sp.
**Speiseria ambigua* Kessel
**Strebla carolliae* n.sp.
**Trichobius dugesioides* n.sp.
″ *galei* n.sp.
* ″ *joblingi* n.sp.
Natalus sp.
Trichobius galei n.sp.

Family Vespertilionidae

Myotis chiloensis
  Anatrichobius scorzai n.g., n.sp.
  ?*Joblingia schmidti* Dybas & Wenzel
†Myotis c. oxyotis
  Anatrichobius scorzai n.g., n.sp.
Myotis n. nigricans
  **Anatrichobius scorzai* n.g., n.sp.
  Joblingia schmidti Dybas & Wenzel
Mixed collection of
Myotis n. nigricans and
M. chiloensis
  Anatrichobius scorzai n.g., n.sp.
  Joblingia schmidti Dybas & Wenzel
Myotis sp.
  Anatrichobius scorzai n.g., n.sp.
  Joblingia schmidti Dybas & Wenzel
  †**Trichobius joblingi* n.sp.
Lasiurus egregius
  **Strebla carolliae* n.sp.
  * " *vespertilionis* (Fabricius)
†Rhogeessa parvula minutilla
(=*Rhogeessa io* Greenhall)
  **Trichobius joblingi* n.sp.

Family Molossidae

Molossus bondae
  Trichobius dunni n.sp.
†Molossus major
  Trichobius sp.
  * " *joblingi* n.sp.
†Molossus "nigricans"
  Trichobius sp.
†Molossus "rufus"
  **Strebla consocius* n.sp.
  Trichobius sp.
†Molossus sp.
  Trichobius sp.

Miscellaneous

From mixed collection of
D. rotundus, P. hastatus,
C. perspicillata, G. soricina,
T. amblyotis & V. vittatus
  †*Trichobius furmani* n.sp.
Bat guano
  Joblingia schmidti Dybas & Wenzel

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